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ABSTRACT

Presented are the student text materials that accompany a workshop to give those with no previous teaching experience the basic skills needed to conduct simple training programs. The basic skills addressed include: identifying instructional needs, specifying objectives, planning the instruction, locating support materials, conducting the instruction, and evaluating performance. The workshop consists of fourteen units which may be given on a variety of schedules. (CLS)

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United States
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Agency

National Training
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Technology Center
Cincinnati OH 45268

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Water

EPA

Basic Instructional Technology

Participant Reference Manual

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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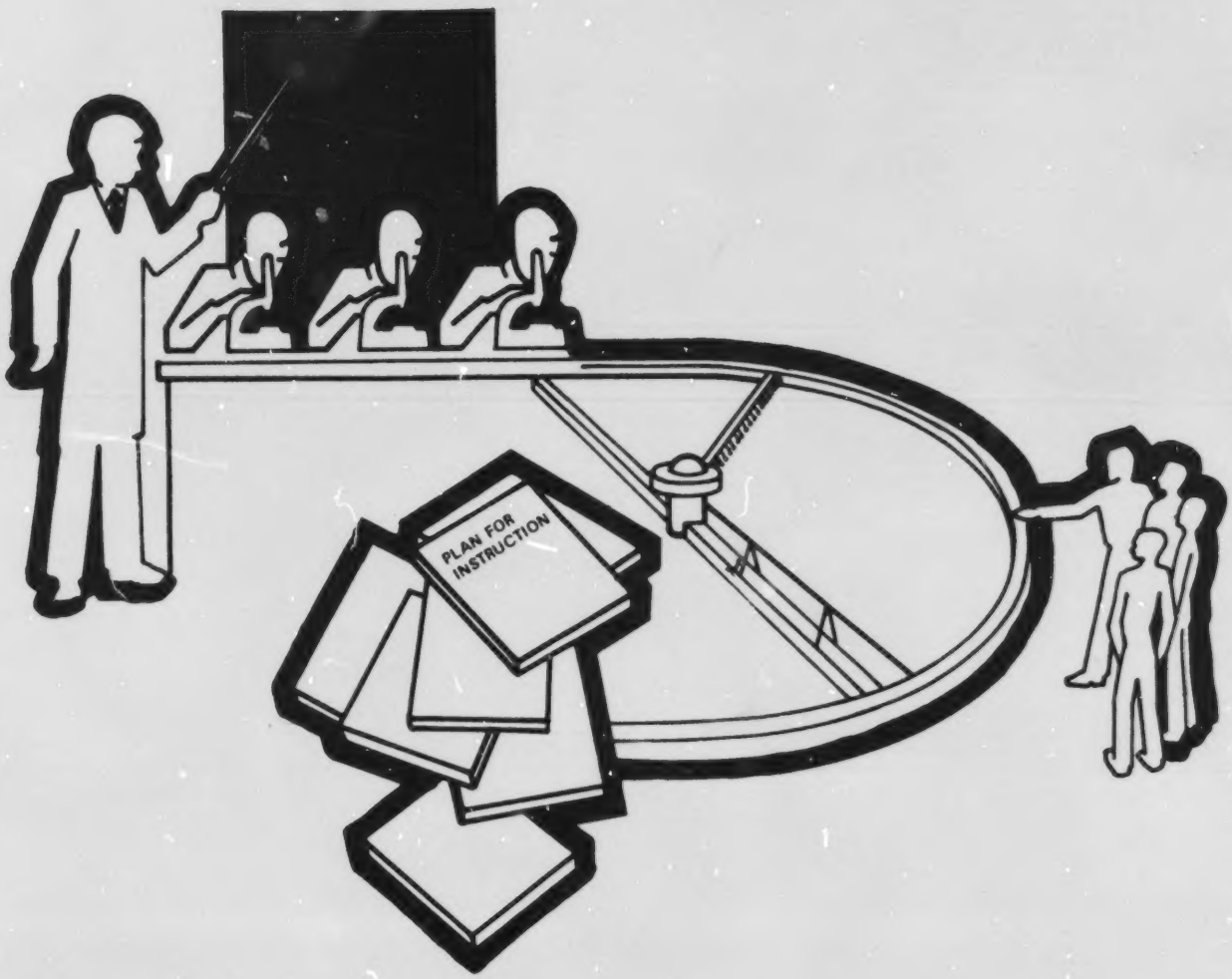

SE 030 116

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FOREWORD

The Basic Instructional Technology Workshop is the first of two workshops developed to provide environmental protection professionals with the skills needed to plan and deliver training programs. The second workshop provides a more advanced treatment of subjects introduced here.

Materials and directions for this basic workshop are presented in two volumes. In addition to this Participant Reference Manual there is a Staff Guide. The Participant Reference Manual contains materials for student use during the workshop, and also is intended for use "on-the-job" in preparing future instructional activities. The Staff Guide is intended for use by the instructor in planning and delivering the workshop.

OTHER U.S. ENVIRONMENTAL PROTECTION AGENCY INSTRUCTIONAL SUPPORT SERVICES AND MATERIALS

INSTRUCTIONAL RESOURCES CENTER

The U.S. EPA National Training and Operational Technology Center (NTOTC) maintains an Instructional Resources Center in Cincinnati, Ohio. A primary objective is the compilation and dissemination of information about water quality and pesticide instructional materials available to interested persons. The "Instructional Resources Center Bulletin" is designed as the communications link between the Center and persons involved in environmental education and training. If you wish to receive free copies of the Bulletin, send your name, position title, organization or institution or agency name, mailing address and phone number to:

IRC Bulletin
U.S. EPA - NTOTC
Cincinnati, Ohio 45268

INSTRUCTIONAL MATERIALS CATALOG

Several audiovisual units and course packages are available for free loan from U.S. EPA's National Training and Operational Technology Center. The "Water Quality Control Instructional Materials" catalog describes slide/tape units, 16 mm films, videocassettes and course packages that can be borrowed. If you wish to obtain a free copy of the catalog, please send address information to:

Instructional Resources Center
U.S. EPA - NTOTC
Cincinnati, Ohio 45268

INSTRUCTIONAL RESOURCES INFORMATION SYSTEM

The Instructional Resources Information System (IRIS) is a computer-based information system. It currently lists information about 3000 printed or audiovisual water quality and pesticide instructional resources available from various individuals, state and federal government agencies, educational institutions and commercial companies throughout the country. For more information about this system, write to:

U.S. EPA Information Dissemination Project
Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

INSTRUCTIONAL SUPPORT PACKAGES for TRAINING ENVIRONMENTAL PROFESSIONALS

The U.S. EPA National Training and Operational Technology Center (NTOTC) has developed instructional packages for several technical courses of interest to water, wastewater and land management personnel. Each package consists of a course manual, a staff guide and visual or audiovisual instructional aids for each topic. The printed manuals are available through EPA's Instructional Resource Information System (IRIS) and/or the National Technical Information Service (NTIS). Instructional aids for teaching the topics are available on free loan from EPA's NTOTC.

Following is a description of the courses for which instructional packages are currently available. The format of the manuals facilitates selection and presentation of those topics of interest to a particular student or group of students.

For more information about obtaining any of these materials, contact:

Instructional Resources Center
U.S. EPA - NTOTC
Cincinnati, Ohio 45268

Self-Monitoring Procedures: Basic Laboratory Skills

For: Treatment plant personnel who are required to monitor effluent discharges and who have had little or no previous experience in laboratory work.

Topics: Review of basic mathematics including the metric system, formulas and percentage; basic chemical laboratory operations such as weighing techniques, use of equipment and preparation or reagents; basic microbiological laboratory operations. Emphasis is on practice of skills.

Time: Seventeen lessons ranging from 0.5 to 3.0 hours. Total instruction time is about 38 hours.

Effluent Monitoring Procedures: Basic Parameters for Municipal Wastewaters

For: Municipal treatment plant personnel who are required to sample, measure and analyze their discharges and who have had little or no previous experience in laboratory work.

Topics: Open Channel Flow Measurements, Biochemical Oxygen Demand, Dissolved Oxygen, pH, Fecal Coliform by MPN and MF methods, Total Residual Chlorine, Suspended and Settleable Solids, Reporting Data. Emphasis is on laboratory practice.

Time: Eighteen lessons ranging from 0.5 to 7.5 hours. Total instruction time is 30 to 45 hours.

Effluent Monitoring Procedures: Metals Analyses

For: Municipal treatment plant personnel who are responsible for performing metal analyses and have had little or no experience in laboratory work.

Topics: Various metals are used as examples of six methods used to determine metals: Boron, colorimetry; Calcium, volumetric; Copper, Magnesium, Manganese, Zinc, direct aspiration atomic absorption; Lead, extraction followed by atomic absorption; Mercury, flameless atomic absorption; Potassium and Sodium, flame photometry. Emphasis is on laboratory practice.

Time: Seven lessons ranging from 2.5 to 5 hours. Total instruction time is 20 to 23 hours.

Effluent Monitoring Procedures: Nutrients

For: Municipal treatment plant personnel who are responsible for performing nutrient analyses and who have had little or no experience in laboratory work.

Topics: Phosphorus, Kjeldahl Nitrogen, Ammonia, Organic Nitrogen (by difference), Nitrate and Nitrite Nitrogen by Cadmium Reduction. Also Chemical Oxygen Demand and Oil and Grease. Emphasis is on laboratory practice.

Time: Nine lessons ranging from 1.0 to 7.0 hours. Total instruction time is 27 to 33.5 hours.

Methods for Determination of Chemical Contaminants in Drinking Water

For: Chemists and technicians with little or no experience in chemical procedures required to monitor drinking water.

Topics: Sampling, Statistics, Quality Control, Safety, Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, Fluoride, Nitrate, Organics (chlorinated Hydrocarbons, chlorophenoxys, trihalomethanes), Chlorine and Turbidity. Representative methods can be selected for the laboratory practice sessions.

Time: Fourteen lessons ranging from 1.0 to 3.8 hours. Total instruction time is 26 to 49 hours.

Determination of Residual Chlorine and Turbidity in Drinking Water

For: Chemists and technicians with little or no experience in chemical procedures required to monitor drinking water.

Topics: Compliance Requirements, Total Residual Chlorine and Turbidity. Emphasis is on laboratory practice.

Time: Five lessons ranging from 0.75 to 1.5 hours. Total instruction time is 5 hours.

Inorganic Analyses in Water Quality Control Programs

For: Chemists and technicians with chemical laboratory experience, 1 year of college level inorganic chemistry and 1 semester of quantitative analysis (or equivalent).

Topics: Sample Handling, Compliance Methodology, Safety, Analytical Techniques, Volumetric Analysis, Precision, Accuracy, Quality Assurance Programs, Acidity and Alkalinity, Total Residual Chlorine, Fluoride, Hardness, Nitrate and Nitrite Nitrogen, Total Phosphorus, Total and Suspended Solids, Specific Conductance, Turbidity. Emphasis is on laboratory practice.

Time: Nineteen lessons ranging from 0.5 to 5.25 hours. Total instruction time is 30 hours.

Organic Analysis in Water Quality Control Programs

For: Chemists and technicians with chemical laboratory experience, 1 year of college level organic chemistry and one semester of quantitative analysis (or equivalent).

Topics: Sample Handling, Compliance Methodology, Safety, Control of Analytical Performance, Spectrophotometer and Calibration Graphs, Gas Chromatography, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand, Chlorinated Hydrocarbons, Total Organic Carbon, Total Kjeldahl and Organic Nitrogen, Oil and Grease, Phenolics, Polychlorinated Biphenyls, Surfactants. Emphasis is on laboratory practice.

Time: Twenty-one lessons ranging from0.5 to 5.25 hours. Total instruction time is 26 to 30 hours.

Bacteriological Methods in Water Quality Control Programs

For: Bacteriologists and technicians with bacteriological laboratory experience including sample inoculations, transfers, media preparation and handling, and related skills.

Topics: Compliance Methodology; Chlorine Determinations and Turbidity; Bacterial Indicators; Equipment, Media and Solutions, Sample Volumes, Sample Collection and Test Procedures for both the Multiple Dilution Tube (MPN) and Membrane Filter (MF) methods; Statistics and Geometric Means. Emphasis is on laboratory practice.

Time: Twenty-one lessons ranging from 0.75 to 4.0 hours. Total instruction time is 28.75 hours.

Land Application of Wastes

For: Engineers, scientists, waste management specialists and other professionals with at least the equivalent of an undergraduate degree in engineering, agriculture or a related discipline.

Topics: Course integrates pertinent information from sanitary and environmental engineering, agronomy, soil science, agricultural engineering, economics and law as applicable to utilizing land for the application of various types of wastes. Lessons are: Soil as a treatment medium, Site evaluation procedures, Design approaches, Social factors, Vegetative cover, Alternative systems, Monitoring, Nitrogen management, Phosphorus management, Toxic element interactions, Organics, Legal aspects, Crop selection, Non-crop uses, Costing procedure, Water management and climate effects.

Time: Twenty-one modules ranging from 0.5 to 3.0 hours. Designed for a workshop setting of about 40 hour duration.

Note: Materials were developed by a grantee.

Erosion and Sediment Control, Audiovisual Training Program

For: Those responsible for erosion and sediment control, management, inspections or State standard development or support.

Topics: Erosion and sediment control, Soils, Rainfall-runoff relationships, Erosion and sedimentation, Plant materials, Control of runoff during construction, Vegetative soil stabilization, Stream erosion control, Temporary soil stabilization, Sediment from construction, Control planning, Wooded sites, Roles and responsibilities.

Time: Thirteen modules, self-paced. The package is designed for both self-study and for group presentation.

Note: Materials were developed by a contractor.

CURRICULUM GUIDES

Curriculum guides for training water quality control personnel have been developed by various institutions and are available for use and adaptation by others. For further information about the following, contact the source cited.

A Two-Year Water Quality Monitoring Curriculum

Source: Ulster County Community College
Attn: Professor Richard Glazer's Office
Stone Ridge, New York 12484

Wastewater Technology: A Two-Year Post-High School Instructional Program

Source: Charles County Community College
Attn: Mr. William Engel's Office
P.O. Box 910
La Plata, Maryland 20646

Wastewater Engineering Technology Program

Source: Clemson University
Attn: Dr. Joseph Allen's Office
Clemson, South Carolina 29631

Note: This is a four year program.

Bachelor of Engineering Technology Curriculum in Water Quality Management

Source: Pennsylvania State University
Attn: Dr. Charles Cole's Office
Capitol Campus, W 261
Middletown, Pennsylvania 17057

Note: This is a two + two or a four year program.

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INTRODUCTION

Basic Instructional Technology Workshop Goal

The overall goal of this Basic Instructional Technology Workshop is to provide environmental protection professionals with basic training in the techniques of planning and delivering instruction on environmental quality and control subjects. Specifically, this workshop is intended to give those with no previous teaching experience the basic skills of identifying instructional needs, specifying objectives, planning the instruction, locating support materials, conducting the instruction (using various instructional formats including the lecture), and finally, evaluating the performance of those who complete the instruction. By the end of this workshop, the concepts and principles composing each of these topics will have been described and demonstrated and participants will have practiced their application and received feedback on their performance.

Description of the Workshop

This workshop consists of fourteen units of instruction totalling nearly forty hours of classroom time. It is designed to be given on a variety of schedules ranging from one solid week to several weekends or a series of twelve half-days or evenings.

The emphasis of the Basic Instructional Technology Workshop is on the development of teaching skills. Specifically, this workshop is intended to give those with no previous teaching experience the basic skills needed to conduct simple training programs. Most of the topics within this workshop are treated on a strictly applied basis with a minimum of theory and technical explanation. The advanced workshop provides more detailed treatment of many of these subjects.

Use of the Manual

This manual is designed to function as a learning aid during the workshop and as a basic reference tool once the workshop is completed. It consists of three kinds of materials: Unit Overviews, Content Summaries, and readings or assignments. A Unit Overview is provided for each of the fourteen units to describe the role of that unit within the workshop and a brief description of its content and objectives. Content Summaries are provided where relevant as a formal kind of "class notes" highlighting the key points to be gained from the workshop's instructional activities in given unit. Individual readings and assignments are also included where appropriate. As the workshop proceeds you will also receive a variety of additional handouts and exercises for eventual inclusion within the appropriate units of instruction.

Workshop Plan and Schedule

The table on the following pages, "Summary Plan of Instruction," briefly describes the content, duration, and instructional methods of this workshop.

SUMMARY PLAN OF INSTRUCTION

Unit of Instruction	Time	Method(s)	Content Outline
Unit One Introduction	2½ hours	-Lectures -Assignment	-Introduction to Workshop -Participant introductory presentations
Unit Two Problem Analysis	2 hours	-Lectures -Assignment	-Introduction to problem analysis -Categories of problems -Use of Problem Definition Worksheet
Unit Three Task Analysis	2¼ hours	-Lecture -Demonstration -Assignments	-Introduction to job analysis and the use of Task Summary Sheet -Practice application
Unit Four Objectives Specification	4 hours (one hour may be done over-night)	-Lectures -Self-instruction -Guided discussion -Assignments	-Introduction to behavioral objectives and performance levels -Practice in writing objectives
Unit Five Evaluation Techniques	4 hours	-Lectures -Assignments	-Principles and concepts of evaluation -Constructing written tests -Evaluating job performance
Unit Six Instructional Methods and Media	3 hours	-Lectures -Demonstration -Guided discussion -Assignments	-Principles of learning -Rules for organizing instruction -Teaching techniques -The Instructional Methods Selection Table, Media Selection Table, and Lesson Planning Form

Unit of Instruction	Time	Method(s)	Content Outline
Unit Seven Lesson Planning	3½ hours	-Lectures -Demonstration -Assignment	-Process of lesson planning -Using the IPW
Unit Eight Developing Oral Communication Skills	2 hours	-Lecture -Demonstration -Participant presentations	-Characteristics of an effective oral presentation
Unit Nine Development of First Presentations	1½ hours (1 hour may be done overnight)	-Assignment	-Working from prepared IPWs for Unit Ten, each participant develops and practices a short presentation
Unit Ten Instructional Media and Related Resources	5½ hours	-Participant presentations -Self-instruction	-Characteristics of various media -Operation of equipment -Media selection -IRIS, IRC
Unit Eleven Classroom Management	1 hour	-Lecture -Guided discussion	-Physical and interpersonal environments and communication -Techniques for managing instruction and maintaining attention
Unit Twelve Development of Second Presentations	3 hours (2 hours may be done overnight)	-Assignment	-Working from their notes and lesson titles, participants prepare objectives, evaluation items, IPWs, and presentations for Unit Thirteen lessons
Unit Thirteen Workshop Summary	5 hours	-Participant presentations	-Workshop is summarized and reviewed through participant presentations -Participants receive feedback on quality of the preparation and presentation

Unit of Instruction	Time	Method(s)	Content Outline
Unit Fourteen Evaluation and Conclusion	1½ hours	-Assignment -Guided discussion	-Workshop participants complete and correct post-test -Participants evaluate workshop

INDEX TO UNITS

UNIT ONE - INTRODUCTION

UNIT TWO - PROBLEM ANALYSIS

UNIT THREE - TASK ANALYSIS

UNIT FOUR - OBJECTIVES SPECIFICATION

UNIT FIVE - EVALUATION TECHNIQUES

UNIT SIX - INSTRUCTIONAL METHODS AND MEDIA

UNIT SEVEN - LESSON PLANNING

UNIT EIGHT - DEVELOPING ORAL COMMUNICATION SKILLS

UNIT NINE - DEVELOPMENT OF FIRST PRESENTATIONS

UNIT TEN - INSTRUCTIONAL MEDIA AND RELATED RESOURCES

UNIT ELEVEN - CLASSROOM MANAGEMENT

UNIT TWELVE - DEVELOPMENT OF SECOND PRESENTATIONS

UNIT THIRTEEN - WORKSHOP SUMMARY

UNIT FOURTEEN - EVALUATION AND CONCLUSION

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT ONE
INTRODUCTION

Estimated time for unit - Two hours thirty minutes

The CONTENT of this unit:

The emphasis of the Basic Workshop is on the development of teaching skills. Specifically, this workshop is intended to give those with no previous teaching experience the basic, practical skills of identifying instructional needs; specifying objectives; planning the instruction; locating support materials; conducting the instruction (with an emphasis on oral communication and the instructor's role in effective instruction); and finally, evaluating the performance of those who complete the instruction. As the introduction to the workshop, this unit provides an overview of the workshop's content and purpose. Specific attention is given to defining the need for this kind of training and the precise ways in which this workshop addresses those needs. Specific topics covered in this unit include the introduction of the Instructional Package Worksheet and a process for the systematic design of training materials.

The OBJECTIVES of this unit:

Through the activities of this unit you will:

-develop an appreciation for the benefits of systematic instructional planning
-become familiar with fellow workshop participants
-be able to describe the use of the Instructional Package Worksheet
-understand the general plan of the workshop

The PURPOSE of this unit:

This unit has been designed to provide a smooth beginning to the overall workshop.

The RESOURCES for this unit:

1. Content Summary
2. Instructional Package Worksheet

UNIT ONE: INTRODUCTION
CONTENT SUMMARY

This workshop will show how to plan effective training according to the following model.

Phase One: ANALYSIS

1. Define the problem (Unit Two)
2. Analyze the tasks (Unit Three)

Phase Two: DESIGN

3. Specify instructional objectives (Unit Four)
4. Determine evaluation activities (Unit Five)

Phase Three: DEVELOPMENT

5. Select instructional methods and media (Unit Six)
6. Develop instructional strategies (Unit Seven)

Phase Four: DELIVERY and REVISION

7. Deliver instruction (practice provided in Units Ten and Thirteen)
8. Evaluate and revise (considered in Unit Fourteen)

The techniques and procedures presented in Units Two through Seven all yield information which becomes the input for filling out the form on the following page.

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering competencies

Objective

Behavior

Conditions

Acceptable Performance

Justification

Evaluation Activities

Resources

Instructional Approach

BASIC INSTRUCTIONAL TECHNOLOGY
PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT TWO
PROBLEM ANALYSIS

Estimated time for unit - Two hours

The CONTENT of this unit:

This unit introduces problem analysis as the first step in the systematic design of training materials. The Problem Definition Worksheet is explained as a guide to the process of problem analysis. A simulation exercise is conducted to enable participants to complete a problem analysis in a familiar work setting.

The OBJECTIVES of this unit:

As a result of this unit's instruction, you will be able to apply a systematic procedure for defining the nature of personnel performance problems in typical work settings. You will also learn to judge when such problems are likely to be effectively solved through training programs.

The PURPOSE of this unit:

To be effective, training must be designed to address specific, well-defined problems. This unit presents a systematic procedure for defining such problems.

The RESOURCES for this unit:

1. Content Summary

UNIT TWO: PROBLEM ANALYSIS
CONTENT SUMMARY

Problem

A discrepancy or deficiency between the way things are and the way things ought to be.

Categories of Problems

Skill or Knowledge Problems - when people do not know what to do or how to do it.

Motivation or Incentive Problems - when people know what to do but do not want to do it.

Environmental Problems - when people know how to do something and want to do it, but something about the work situation or organization will not let them perform effectively.

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT THREE
TASK ANALYSIS

Estimated time for unit - Two hours fifteen minutes

The CONTENT of this unit:

This unit presents a systematic process for analyzing a job in terms of its component tasks and identifying those tasks which are to be the focus of a training effort. Use of the Job Task Summary Sheet and Task Detailing Sheet is explained and demonstrated.

The OBJECTIVES of this unit:

The instructional activities of this unit will enable you to list and detail the tasks composing a specific job. You will also learn to further define the tasks in terms of the steps required to complete them and the various types of behavior they represent.

The PURPOSE of this unit:

The development of specific instructional objectives and overall planning of the training activity requires the prior specification of the particular job, task, and task-steps which are to be the focus of instruction.

The RESOURCES for this unit:

1. Content Summary

UNIT THREE: TASK ANALYSIS
CONTENT SUMMARY

Definitions

A job is the occupational title or position held by an employee.

A job description is a statement (or statements) which outlines the duties and responsibilities of the job.

Tasks are the skills or operations which belong to a specific duty or area of responsibility. Each task consists of specific steps.

Task analysis is the act of dividing a duty into all of its components. It results in a list of everything an employee must do to advance the work to completion.

Types and Levels of Behavior

COGNITIVE — Actions which involve knowing, understanding or applying information; remembering or using facts or ideas.

- Knowledge - ability to state a fact, symbol, definition, procedure, etc.
- Comprehension - understanding the meaning of a piece of information; ability to explain or classify.
- Application - using knowledge and comprehension to complete some activity; uses formula or rule, follows procedure.
- Problem-solving - determining what must be done to perform some task - creates a procedure; combines rules or formulas into new rule.

AFFECTIVE

Expressions of feeling or interest; the adoption of an attitude or belief; the motivation to do something.

PSYCHOMOTOR

Physical action, speed or agility; the performance of a particular body movement.

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT FOUR
OBJECTIVES SPECIFICATION

Estimated time for unit - Four hours

The CONTENT of this unit:

This unit explains the nature and procedure for constructing specific instructional objectives. Using information from the Task Detailing Sheet, participants are able to practice writing instructional objectives for specific tasks in a familiar work setting. The role of the Lesson Planning Form is also introduced.

The OBJECTIVES of this unit:

By the end of this unit you will be able to:

-List and explain the four components of an instructional objective
-Classify objectives according to level of behavior required
-Write instructional objectives according to the four-part format
-Write cognitive instructional objectives on more than one performance level

The PURPOSE of this unit:

Instructional objectives are the cornerstone of training activities. When properly defined, they will help the instructor organize the training, and will enable both the instructor and the trainee to identify the successful outcomes of the training effort.

The RESOURCES for this unit:

1. Assignment 4.1, Writing Instructional Objectives
2. Assignment 4.2, Types and Levels of Objectives
3. Lesson Planning Form

UNIT FOUR: OBJECTIVES SPECIFICATION
LESSON 2 of 3: WRITING INSTRUCTIONAL OBJECTIVES

ASSIGNMENT 4.1 WRITING INSTRUCTIONAL OBJECTIVES

Estimated time: Sixty minutes

This is a self-instructional assignment. Please read the material and complete the exercises as directed.

WRITING INSTRUCTIONAL OBJECTIVES

Among the most useful educational planning devices are instructional objectives. They provide a blueprint for measuring the goals or desired outcomes of a learning experience. Instructional objectives are very useful to both the instructor and the learner for selecting or designing instruction, for directing the students' efforts to accomplish the intended objectives, and for evaluating the success of the instruction. The purpose of this module is to help you write clear instructional objectives. Read the brief description of the parts of an instructional objective given in the box below. After reviewing this description you should be able to label segments of objectives as either "audience," behavior," "conditions" or "acceptable performance" without making any errors.

INSTRUCTIONAL OBJECTIVE COMPONENTS

Instructional objectives are measureable observable goals for learning. They specify the intended outcomes of instruction in terms of the learner's behavior.

Effective instructional objectives contain the following four components:

1. Audience - who the students are or student characteristics or prerequisite competencies students should have
2. Behavior - what students should be able to do as a result of the learning experience
3. Conditions - constraints, requirements, limitations, or resources with which the behavior must be performed
4. Acceptable Performance - required level or quality of performance of the behavior

Now try the exercise on the next page.

Component Exercise

This exercise is designed to test your understanding of the four components of instructional objectives (Audience, Behavior, Conditions, Acceptable Performance). Various pieces of objectives are given below. Identify each piece in terms of the component it represents by writing the components name in the space provided.

Example: with the aid of the instruction manual — conditions

1. with accuracy to four decimal places _____
2. a chemical engineer with two years of experience _____
3. with room temperature between $12^{o}C$ and $20^{o}C$ _____
4. measure and place into the beaker ten moles of HC1 _____
5. wastewater treatment plant lab technicians with no formal training in chemistry _____
6. with no more than three errors _____
7. using a calculator and F tables _____
8. weigh and record the weight of the sample solution _____

Check your work against the answers on the next page.

Answers to component exercise

1. acceptable performance
2. audience
3. conditions
4. behavior
5. audience
6. acceptable performance
7. conditions
8. behavior

If all of your answers were correct, go on to the next page. If you missed any items, go over the material on the first page of this assignment and check to see that you understand why the answers given above are correct. Then continue.

The next four sections of this assignment describe in detail the four components of instructional objectives. Each section provides opportunities for practice in applying the various concepts which will also enable you to assess your progress.

I

Audience

Effective instructional objectives must be designed with a particular audience in mind. Not everyone needs to learn the same things. Thus, when the decision is made to plan a piece of instruction to teach a particular behavior, specific attention must be given to defining the exact nature and present capabilities of the intended students or trainees.

Failure to identify the precise audience for instruction can lead to a number of problems. The instruction might be too easy for the trainees/students who eventually use it because they have already mastered the intended objectives. On the other hand, the material might be too difficult if it assumes that the trainees already possess certain competencies which in fact they do not. The more precisely you can specify the intended audience for the instructor the better.

Audience Exercise

The audience component in each of the following objectives is not clearly defined. Underline the faulty audience component and rewrite a more appropriate audience component for the objective.

Example:

By the end of the training they will be able to collect water samples

Improved audience statement: the wastewater treatment Operator II's.

1. By the end of the fourth week of instruction, they should be able to balance 10 chemical equations with only two errors.

   Improved audience statement: _____

2. Using a hand calculator and T tables, he will be able to perform a test of Pearson's correlation on two samples with 100% accuracy.

   Improved audience statement: _____

3. By the conclusion of this assignment, workshop participants will be able to construct clear, effective instructional objectives.

   Improved audience statement: _____

4. Through the slide-tape unit on Engineering Aspects of Water Fluoridation, you will learn to identify and properly apply necessary equipment and chemical procedures.

   Improved audience statement: _____

Check your work against the suggested answers on the next page.

Audience Exercise - Suggested Answers

Listed below are possible clarifications of the audience components in the sample pieces of objectives given above. Check your efforts to clarify the audience statements against these examples. Do your audience statements seem to be as clear or specific as these? If not, why?

1. ...trainees with basic mathematical skills but no background in chemistry...

2. ...a student who has completed all of the exercises in the Basic Statistics Handbook...

3. ...workshop participants with no previous instructional experience...

4. ...operators and supervisors of water treatment plants who need to learn how to add fluorides to a water supply...

If any of your audience statements seem vague or general by comparison, clarify them before going on to the next page.

II

Behavior

The description of the intended behavior is the most critical component of an instructional objective. It should clearly define the intent of the instruction in terms of a specific capability to be possessed by those who complete the instruction. It describes what someone will be able to do.

When learning is expressed in terms of observable behaviors, the instructor accepts the trainee's performance of that behavior as evidence that the objective has been achieved. Clear behavior statements effectively answer such questions as "How will I be able to judge when the trainees understand the material?" or, "What evidence will I accept as proof that they have learned what I taught?"

Defining the intent of the instruction in terms of explicit behaviors (capabilities, competencies, or performances) is also helpful to the trainee. Clearly stated objectives enable students to identify what is expected of them and when they have accomplished it.

Failure to describe the objective using observable behaviors can result in confusion over the true purpose of the instruction and evaluation of its achievement. For example, what does it mean "to know" how to operate a piece of equipment? Does "to know" mean to describe how it operates, or to actually operate it, or perhaps even to fix it when it breaks? Simply describing an objective in such vague terms as "to know" or "to understand" does not clearly communicate the intent of the instruction. A clear and specific statement in the objective of what someone will be able to do leaves little doubt about the capabilities which the learner should possess.

Certain verbs are more useful for clearly defining observable behaviors than others. For example, while "to understand" is vague, "to construct" leaves little doubt about the intended performance. Further examples are listed below.

Vague Terms Which Refer to Unobservable Behaviors:	Terms Which Refer to Clearly Observable Behaviors:	
to know	to write	to perform (a test)
to really know	to recite	to trouble-shoot
to fully appreciate	to draw	to start up
to grasp the meaning of	to dictate	to analyze
to conceptualize fully	to diagram	to adjust
to believe in	to list	to divert
to gain an understanding of	to name	to operate
to concentrate on	to construct	to repair
to be mindful of	to separate into groups	
to understand	to compare and decide	
	to identify (circle and underline)	
	to measure and record	

Exercise on Behavior Component

Selected fragments of objectives are listed below. Each fragment contains a more or less observable description of the intended behavior. For each of the items, complete the following activities:

1. Underline the word or words which describe the intended behavior or outcome of the instruction.
2. Decide whether the underlined word or phrase describes a specific and observable, or vague and unobservable performance. Record your decision by checking the appropriate blank on the right.
3. For each statement you identify as vague and unobservable, create a more specific statement, and write it in the space directly below the original item.

Example:	Specific	Vague
The trainee will know the fire exits for each work area.	___	✓
recite		
1. Fully understand the inspection procedure.	___	___
2. Use the model to demonstrate the process of lubrication.	___	___
3. Name the chemistry tests required of this plant for compliance reports.	___	___
4. Develop a working use of submerged flow rate diagrams.	___	___
5. List four operating conditions which affect the primary sedimentation process.	___	___
6. Identify (label) the sections of a Parshall Flume.	___	___
7. Perceive the differences between the calibration procedures for two applicators.	___	___
8. Measure and record the concentration of fluoride in a sample of drinking water.	___	___
9. Diagram the parts of one applicator acceptable for pest control for outdoor nursery crops.	___	___

Check your answers on the next page.

Answers to Exercise of Behavior Component

	Specific	Vague
1. Fully understand the inspection procedure.	____	x
Describe in writing.		
2. Use the model to demonstrate the process of lubrication.	x	____
3. Name the chemistry tests required of this plant for compliance reports.	x	____
4. Develop a working use of submerged flow rate diagrams.	____	x
Identify components using submerged flow rate diagrams.		
5. List four operating conditions which affect the primary sedimentation process.	x	____
6. Identify (label) the sections of a Parshall Flume.	x	____
7. Perceive the differences between the calibration. procedures for two applicators.	____	x
List.		
8. Measure and record the concentration of fluoride in a sample of drinking water.	x	____
9. Diagram the parts of one applicator acceptable for pest control for outdoor nursery crops.	x	____

Were you able to correctly identify the behavioral terms in each of the examples? Did you have any difficulty in deciding whether they were specific or vague? For those that were vaguely stated, were you able to suggest a more specific statement? If you had any difficulties, review the preceding material and try to resolve the differences between your responses and the ones suggested above before continuing.

Please go on to the next page.

III

Conditions

A third important component of instructional objectives is the description of the conditions under which the desired behavior is to be performed. That is, it is one thing to be able to describe the operation of a water treatment facility from memory, and quite another thing to describe its operation using a model of the facility. The difference between these two performances is in the conditions for the performance (from memory with no aids, as opposed to using a model). The precise nature of the intended conditions can have a major impact on the interpretation of the intended behavior. For example, it is rather unclear what is expected of a student from the statement:

Construct the Periodic Table of the Elements. The task is more clearly clearly expressed as:

Given a list of chemical symbols and their atomic structure, construct the Periodic Table of the Elements. But a rather different performance is suggested with a change in the stated conditions:

Without the use of book, notes, or other outside aids, construct the Periodic Table of the Elements.

As shown by these examples, a clear description of the conditions of the behavior's performance answers such questions as: "With what materials or assistance will the behavior be performed?" or, "Under what circumstances will the performance be evaluated?" Note that describing the conditions of performance is quite different from describing conditions of learning. That is, neither of the example objectives included a statement like, "Given a unit of instruction on the Periodic Table..." Such a statement would have described the conditions under which the behavior was learned rather than the circumstances surrounding its ultimate performance and would not have clarified the precise nature of the behavior itself. Confusing the conditions for learning with the conditions for performance is a common mistake that should be avoided in constructing good instructional objectives.

Try the exercise on condition statements on the next page.

First Exercise on Condition Statements

Review the following list of possible condition statements. Circle those statements which might be used in an instructional objective to identify the conditions for the intended behavior's performance.

1. name the hazards involved

2. after studying Chapter Three

3. with the use of a calculator

4. without the use of the Instruction Manual

5. raise the heated solution to eye level

6. in less than 30 minutes

7. graduate students in chemical engineering

8. using the computational formula and table of commom logarithms

Go on to the next page.

Answer to First Exercise on Condition Statements

You should have identified the following phrases as condition statements:

3. with the use of a calculator

4. without the use of the Instructor Manual

6. in less than 30 minutes

8. using the computational formula and table of common logarithms

If you missed any of these or chose others, reread the previous material to determine why your response was incorrect. Ask your instructor for additional help if necessary. Then, continue with the exercise on the next page.

Second Exercise on Condition Statements

Write a clear description of the conditions under which the behavior is to be performed for each of the following incomplete instructional objectives.

Example: First year biology students will label with 100% accuracy the four chambers of the heart, the aorta and the pulmonary artery.

Conditions: given a diagram of the human heart.

1. Wastewater Lift Station Maintenance Mechanic II's will diagnose malfunctions in pumping station equipment. Their diagnoses must be correct as determined by their supervisors.

   Conditions: _____

2. Sewage Treatment Technology students will describe what happens during each of the major stages of biological treatment.

   Conditions: _____

3. Students enrolled in the course "Water Supply Studies" will state the maximum acceptable nitrate content allowed in drinking water according to the Safe Water Drinking Act.

   Conditions: _____

4. Weed Control Farm Advisors will be able to calculate the standard deviation of field sample particulate densities.

   Conditions: _____

Check your work against the suggested responses on the next page.

Suggested Responses to Second Exercise on Condition Statements:

1. Given a faulty piece of equipment, its service manual, and the lift station tool set.

2. In no more than five minutes given a list of the stages of biological treatment.

3. Without the use of books, charts, notes, or other aids.

4. Given the density measures of the samples collected.

Your answers may be different from the ones suggested here. To be considered correct, your answers must:

1. Specify the conditions under which the performance is to be evaluated; and
2. not describe the conditions under which the behavior was learned.

Note: It is not necessary to list trivial conditions such as "Given a pencil, blank paper, a desk, chair, etc."

If any of your condition statements seem vague or general by comparison, clarify them before going on to the next page.

IV

Acceptable Performance

The acceptable performance of an effective instructional objective is the degree to which the intended audience performs the desired behavior. It is the standard of performance for considering an objective as successfully completed.

The degree of acceptable performance will differ according to the type and importance of the objective of which it is part. Students learning the names of the fifty states may not be required to list every state from memory. However, a surgeon is expected to perform every step of an operation without error.

Acceptable Performance Exercise

Write a clear description of the degree of acceptable performance required for each of the incomplete objectives below:

1. Given appropriate record sheets Operator I's, while on the job, will read and record all meter levels associated with a specific piece of equipment.

   Acceptable Performance_____

2. Given a faulty water meter, the maintenance staff member will diagnose the problem and repair the meter.

   Acceptable Performance_____

3. Given a blank discharge monitoring report form, the operations log book, and the laboratory record book, the plant superintendent will be able to make the necessary calculations and record the required data on the form.

   Acceptable Performance_____

4. Given a copy of the plant layout, Operator Trainees will identify (by circling) the location of pressure gauges to be checked during rounds.

   Acceptable Performance_____

5. Given a description of a major equipment malfunction, a shift foreman will list the emergency procedures to be followed.

   Acceptable Performance_____

Now check your answers on the next page.

Suggested Answers to Acceptable Performance Exercise:

1. All readings will be recorded at the proper place on the form and will be correct ± 2%.

2. The repaired meter will be in 100% working order.

3. The form will be completed within sixty minutes and will contain no errors.

4. Without error.

5. All procedures will be included and they will be listed in sequential order.

Your answers may be different from the ones suggested here. To be considered correct, your answers must specify the degree or standard of performance which is to be an acceptable evidence that the instructional objective is successfully completed.

If any of your performance statements seem vague or general in comparison to the suggested answers, clarify them.

Then go on to the next page.

SUMMARY

Instructional objectives represent the instructor's goals or desired outcomes for the learning experience. Effective instructional objectives can be very useful to the instructor for the selection and designing of instruction, learning materials and tests, for evaluating the success of instruction, and for directing the student's efforts. Students find instructional objectives useful to direct their learning and to know exactly what performance is required. It is very important, if the instructor's desired outcomes are to be realized, (1) that the objectives are appropriate for the particular audience, (2) the performance which demonstrates the desired outcome be specified in terms of observable behavior, (3) intended performance conditions be clearly communicated, and (4) the degree of acceptable performance be specified.

All components of the instructional objective need not always be written when the instructor is certain there is no misunderstanding. These components should be viewed only as guides or aids for the instructor in his/her management of the learning process. Clear, effective instructional objectives offer students not only enhanced learning but also positive experiences since unclear directions and misunderstandings are minimized.

FINAL EXERCISE: PRACTICE IN WRITING OBJECTIVES

On a separate piece of paper, write two instructional objectives that properly illustrate the four components of clear objectives. Write one objective for a class on how to complete personal income tax forms and one objective for a basic typing course. Your completed objectives will be reviewed by another workshop participant for their clarity and format.

UNIT FOUR: OBJECTIVES SPECIFICATION
LESSON 3 of 3: LEVELS OF OBJECTIVES

ASSIGNMENT 4.2 TYPES AND LEVELS OF OBJECTIVES

Estimated time: Forty-five minutes

> This is a self-instructional assignment. Please read the material and complete the exercises as directed.

TYPES AND LEVELS OF OBJECTIVES

In Unit Three's introduction to the Task Detailing Sheet, the concepts of type of behavior and level of cognitive behavior were introduced. It was explained that the performance of various steps of a task may require very different types of behavior (cognitive, affective, or psychomotor), or represent a particular level of cognitive behavior (knowledge, comprehension, application, or problem solving). The particular type and level of behavior called for in a step's performance must be considered in designing effective training on that step. Good instructional objectives are written so as to clearly indicate the type and level of behavior being taught.

This assignment reviews the key concepts and provides practice in constructing objectives for different types and levels of cognitive behaviors. (An emphasis is placed on cognitive objectives since they are the most common and important learning outcomes for training programs designed to address skill or knowledge problems.)

Types of Behavior and Instructional Objectives

Cognitive behaviors involve knowing, understanding, or applying information or procedures. This workshop is almost totally concerned with providing training in the cognitive behaviors required to plan and conduct instruction. Excerpts from some of the workshop's objectives addressing cognitive behaviors are listed below.

"...participants will be able to list the phases of a systematic approach to instruction and explain each briefly..."

"...participants will be able to plan and construct simple written tests..."

"...participants will be able to identify appropriate uses of audiotapes..."

Affective behaviors involve feelings and attitudes towards something. They include expressions of interest, the adoption of an attitude or belief, or the motivation to do something. Affective behaviors can have an important influence on how a particular job or task is performed. Excerpts from several of this workshop's objectives which address affective behaviors follow.

"...participants will express increased interest in learning procedures for planning effective instruction..."

"...participants will feel more at ease speaking in front of a group..."

Psychomotor behaviors involve physical action, the performances of a particular body movement. Psychomotor behaviors become the focus of training activities when a particular task requires physical agility, speed, precision, or coordination. (While cognitive or affective behaviors may also be involved, the primary behavior of interest is a physical action.)

While psychomotor behaviors are generally not the focus of this workshop, the unit on public speaking skills does contain a few objectives addressing very specific kinds of psychomotor behaviors.

"...speakers should maintain eye contact with audience..."

"...speakers will vary their volume level and tone of voice..."

"...speakers should not exhibit any distracting mannerisms..."

Many activities involve all three types of behavior to some degree. Even a simple task like "check the filter" requires that the employee knows what is to be done (cognitive), chooses to do it (affective), and physically removes and inspects the filter (psychomotor). However, in most training situations it is readily apparent that one type of behavior is the major concern. In this example, the primary emphasis would be on the cognitive behavior of knowing to check the filter (probably as one step in a larger maintenance task).

For most of the training programs you will be concerned with, the instructional objectives will typically address cognitive behaviors. Sometimes they may involve affective behaviors. Only rarely will a psychomotor behavior be the target of instruction. (Most required psychomotor behaviors, like the use of a screwdriver, are simply assumed to be a basic entering competency for anyone holding a job.)

Exercise on Identifying Instructional Objectives by Type of Behavior

Read the following objectives and, for each, decide whether the concern is with cognitive, affective, or psychomotor learning. Indicate your decision by labeling each objective by type of behavior in the blank on the right.

1) As a result of this public awareness campaign, visitors to state parks will come to value an unpolluted environment as shown by an increased effort to keep the park free of debris indicated by an observable decrease in litter and increase in the amount of trash in receptables.

Type of behavior?_____

2) Through this program, trainees will learn to write instructional objectives which clearly specify the intended audience and behavior and the conditions and nature of the acceptable performance. The ability to construct such objectives for training in work-related tasks will be evaluated through peer review of various exercises using the rating form provided.

Type of behavior?_____

3) As a result of the redesigned materials, plant mechanic trainees will maintain a higher level of interest in the training program as demonstrated by decreased absenteeism and increased participation in optional activities.

Type of behavior?_____

4) The Basic Level Workshop will enable environmental facility operators with no previous instructional experience to apply a systematic model for planning and delivering instruction. Achievement of this objective will be evaluated in workshop exercises which require participants to design and deliver an actual lesson. The quality of that performance will be evaluated using specially designed rating scales.

Type of behavior?_____

Check your answers on the next page.

Answers to Exercise on Identifying Instructional Objectives by Type of Behavior

1) Affective behavior

2) Cognitive behavior

3) Affective behavior

4) Cognitive behavior

If you failed to properly identify any of the four objectives, reread the preceding material and reconsider your answer(s). Talk to your instructor if you have any particular questions.

Levels of Cognitive Objectives

As originally explained in Unit Three, there are four levels of cognitive behavior as follows:

I) Knowledge - the ability to state a fact, describe a symbol or repeat a definition.

II) Comprehension - the ability to explain or classify procedures or information.

III) Application - the ability to apply an existing knowledge or comprehension of something to conduct some procedure or derive information.

IV) Problem-Solving - the ability to invent new information or procedures based on past experience.

The four levels are listed in order from the simplest to the most complex forms of cognitive behaviors. Each advanced level assumes the possession of preceding levels of behavior. Thus, problem-solving activities require that the relevant facts or procedures are known (Level I), understood (Level II), and can be properly applied (Level III) to the new situation.

When "cognitive behavior" is the focus of instruction, it is important that the objective specifies the precise level of behavior desired. The design of the training activities will vary greatly depending on the level of cognitive performance required. For example, it is one thing to teach someone to name the parts of a piece of equipment (Level I), and quite another to prepare him/her to "trouble-shoot" problems in the operation of that equipment (Level IV).

One way to insure that an instructional objective specifies the desired level of cognitive performance is to carefully consider the verb used to describe the behavior. Different verbs naturally refer to different levels of cognitive performance. The list on the next page provides some example verbs for describing each level. Read the list carefully and notice how the level of behavior suggested by the verbs changes from column to column.

USEFUL VERBS FOR EXPRESSING COGNITIVE BEHAVIORS IN WRITING INSTRUCTIONAL OBJECTIVES

Knowledge	Comprehension	Application	Problem-Solving
draw	classify	analyze	create
duplicate	categorize	calculate	develop
find	cite evidence for	compute	devise a method
gather data	compare	conduct a test	discuss critically
identify	contrast	construct	evaluate
label	define	estimate	formulate hypotheses
list	describe	install	generalize from data
match	differentiate	interpret	infer
repeat	discriminate	manipulate apparatus	integrate
recognize	distinguish between	measure	invent a new solution
state	explain	organize data	manipulate ideas
	give examples of	plot a graph	plan
	illustrate	prepare	predict
		produce	propose reasons and defend them
		prove	reorganize
		reformulate	solve a problem
		relate	synthesize
		specify limitations and assumptions	

Exercise on Identifying Levels of Cognitive Behaviors

Read the following objectives and, for each, decide whether the specified cognitive behavior is at the knowledge, comprehension, application, or problem-solving level. Indicate your decision by labeling each objective by level of cognitive behavior in the blank on the right. (You may want to refer to the verb list on the preceding page if you have any difficulty deciding on the level.)

1) The activities of this lesson will enable participants to identify various important variables in the physical and interpersonal environment of the classroom. . .

Level of cognitive behavior?_____

2) By the conclusion of this lesson, participants will be able to define all of the principles for designing good instructional graphics when given the names of those principles in a brief exercise.

Level of cognitive behavior?_____

3) Working with the task analysis and objectives developed as parts of previous units, participants will learn to plan an evaluation and offer explanations for their decisions.

Level of cognitive behavior?_____

4) By the conclusion of this lesson, participants will be able to define the concepts of "job," "task," and "task analysis" from memory. . .

Level of cognitive behavior?_____

Check your answers against those on the next page.

Answers to Exercise on Identifying Levels of Cognitive Behaviors

1) Knowledge

2) Comprehension

3) Problem-Solving

4) Comprehension

If your answers do not agree with these, reread the previous section and check to see that you understand the concepts involved. You may wish to discuss this material with your instructor.

Exercise on Writing Instructional Objective for Different Levels of Cognitive Behavior

Using specific tasks from your own job, write two complete instructional objectives for each level of cognitive behavior. (It may be useful to refer to the list of verbs again.)

You will hand this exercise in to your instructor for his/her review. Your instructional objectives will be evaluated on the extent to which they contain clear descriptions of the audience, behavior, conditions, and degree. Use additional paper if necessary.

Tasks for which objectives are to be written.

Knowledge	1. 2.
Comprehension	3. 4.
Application	5. 6.
Problem-Solving	7. 8.

Knowledge Level Objectives:
1)

2)

Comprehension Level Objectives:
3)

4)

Application Level Objectives:
5)

6)

Problem-Solving Level Objectives:
7)

8)

Optional Exercise

If there is time remaining, you may wish to try writing affective and psychomotor objectives on some subject or area familiar to you. These objectives should contain the same four components of any good instructional objective. Hand your objectives in to the instructor for his/her review.

LESSON PLANNING FORM

Job Title_____ Task_____

Step_____

Type and Level of Behavior_____
(as appropriate)

1) Instructional Objective:

Audience _____

Behavior _____

_____

Conditions _____

_____

Acceptable Performance _____

_____

2) Entering Competencies: _____

_____

3) Evaluation Activities: _____

_____

4) Instructional Methods: *Using the Instructional Methods Selection Table for guidance, choose the method or methods most suitable for reaching the objective and describe how it will be used.*

METHOD(s)_____

_____

_____

5) Instructional Media. *Use the Media Selection Table to guide your choice of media for use in instruction. List all that apply.*

Appropriate Category of Media	Specific Medium & Title Available
_____	_____
_____	_____
_____	_____

6) Sequence of Instructional Activities. *Outline the specific activities which comprise the instructional approach.*

1._____

2._____

3._____

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT FIVE
EVALUATION TECHNIQUES

Estimated time for unit - Four hours

The CONTENT of this unit:

This unit provides a basic introduction to the techniques of evaluation. Included are sections on the nature of evaluation activities and the use and design of written tests, check lists and rating scales. Opportunities for practice application of evaluation skills is also provided.

The OBJECTIVES of this unit:

By the conclusion of this unit you will be able to:

-define and describe the uses for evaluation.
-describe the nature and appropriate uses of various forms of written tests.
-construct and correct multiple-choice items and short answer test items.
-describe the nature and application of various techniques for job performance evaluation.
-construct, revise, and apply check lists and rating scales.

The PURPOSE of this unit:

Evaluation is a necessary component of any instructional activity. It can be used to motivate students, reinforce the desired outcomes, and provide the instructor with feedback on the progress of the workshop. Evaluation skills are also essential for the assessment of on-the-job performance and the identification of employee training needs.

The RESOURCES for this unit:

1. Content Summary
2. Example Check List
3. Example Rating Scale
4. Assignment 5.1 Constructing Multiple-Choice Items
5. Assignment 5.2 Constructing Short-Answer Items
6. Assignment 5.3 Constructing Check Lists and Rating Scales

UNIT FIVE: EVALUATION TECHNIQUES
CONTENT SUMMARY

Evaluation Defined

Evaluation can be defined as a systematic process for gathering information for decision-making.

Evaluation involves both the description of something and the judgment of its worth in a certain context. More specifically, judgment involves comparison of the thing being evaluated against similar things, or standards of quality.

Training-Related Uses of Evaluation

-To determine existing capabilities of employees
-To provide feedback to trainees
-To provide practice of a new skill
-To certify employee competencies

Evaluation Activities Differ Depending On:

-Who needs to know something?
-What is it they want to know?
-Why do they want to know it?
-When do they want to know it?
-How certain do they have to be about the results?

Written Tests

Written tests are most useful for measuring cognitive behaviors.

Considerations in Test Design

Step One: Define the intended role and function of test.

-Who?
-What?
-Why?
-When?
-How certain?

Step Two: Define the type of behavior to be evaluated.

-Cognitive
-Affective
-Psychomotor

Step Three: Planning the content of the test.

Types of Test Items

1. Short answer and multiple-choice are generally the most efficient and objective test-item formats.
2. Essay items are difficult to guide objectively.
3. True-false items have some limited use but are not that good a test of student performance.
4. Matching items are a specialized form of multiple-choice items.

Rules for Writing Objective Test Items

Test items should:

1) Be clear
2) Be uncluttered
3) Be functional
4) Be at the proper level of difficulty
5) Call on the desired behavior
6) Thoroughly sample that behavior
7) Provide a positive test of that behavior
8) Have clearly correct answers
9) Not "give away" the answer
10) Not "give away" answers to other items

Check Lists and Rating Scales

Rating scales and check lists are useful means of evaluating observable behaviors and, specifically, the on-the-job performance of employees. A check list consists of a list of skills or tasks which the student is expected to demonstrate in the satisfactory performance of a job. A rating scale also is based on a list of skills or tasks to be demonstrated by the student or employee, but additional information is added so that the evaluator can judge the relative quality of the observed performance.

General Rules for Constructing Check Lists and Rating Scales

-Define the behavior to be observed.
-Determine standard for judgment of "good" performance.
-If you are concerned with the presence or absence of a behavior, use a check list.
-If you are concerned with rating or grading the quality of a behavior, use a rating scale.

Design check list and rating scale item to be simple and explicit.

EXAMPLE CHECK LIST: FOCUSING THE MICROSCOPE

Directions: Check each item only if performed properly. Check final square when each step has been performed properly and in correct sequence.

1. Snap low power objective into place ☐
2. Adjust mirror ☐
3. Assume starting point for focus ☐
4. Place slide on stage ☐
5. Adjust course adjustment screw to focus ☐
6. Change to high power ☐
7. Identify image on slide ☐
8. Correct sequence ☐

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EXAMPLE RATING SCALE: WORKMANSHIP

Directions: Place an X on the line at the point which best describes this person on each dimension. You may check anywhere along the line.

1) Quality of Work

Sloppy — Average — Excellent

2) Care of Tools

Careless and Disrespectful — Average — Excellent

UNIT FIVE: EVALUATION TECHNIQUES
LESSON 2 of 3: CONSTRUCTING WRITTEN TESTS

ASSIGNMENT 5.1 CONSTRUCTING MULTIPLE-CHOICE ITEMS

Estimated time: Twenty-five minutes

This assignment is designed to provide you with a review of the basic techniques for constructing the most useful of the selection-type test items for criterion-referenced tests. The introductory reading reviews the characteristics of multiple-choice items and the principles for their construction. An accompanying exercise provides practice in constructing this type of item.

OBJECTIVE: By the conclusion of this assignment, you will be able to construct multiple-choice items.

EVALUATION: Your performance on the exercise may be reviewed in class at the end of this assignment.

DIRECTIONS:

1. Complete the reading entitled "Introduction to Multiple-Choice Items". This should take approximately 10 minutes.

2. Complete one or the other of the two versions of "Exercise in Constructing Multiple-Choice Items". One version of the exercise has been designed for those familiar with wastewater treatment facility operators. The other version of the assignment has been designed for drinking water specialists. Either version of the exercise should require about 15 minutes to complete.

3. Be prepared to participate in a brief discussion or review of your responses to the exercise.

Introduction to Multiple-Choice Items

While there are many kinds of test items (true/false, short-answer, matching, completion), the multiple-choice item is considered the most versatile type of item. It can be used to test a wide variety of behaviors and provides an objective, easily-scored testing format.

The multiple-choice item consists of two major parts: (1) the stem (also called lead, premise, problem, question); and (2) the alternatives (answers, distractors, foils or decoys).

The basic usefulness of the multiple-choice test is that it can answer questions relating to:

1. Definition
   Example item: What means the same as _____?
2. Purpose
   Example item: What is the reason for _____?
3. Cause
   Example item: Under which conditions is this true?
4. Effect
   Example item: If this is done, what will happen?
5. Association
   Example item: What occurs in connection with _____?
6. Identification of error
   Example item: What principle is violated?
7. Difference
   Example item: What is the difference between _____?
8. Arrangement
   Example item: Which is the first step in _____?
9. Common principle
   Example item: Which one of the following is not related to _____?
10. Controversial subjects
    Example item: The x pump is better because _____?

The multiple-choice test item has various advantages and limitations when compared with other teacher-made tests.

Advantages:

1. It can be constructed to measure mental abilities from simple recognition to some aspects of critical thinking (dependent upon skill of test construction).
2. It presents less possibility of guessing the correct answer than other selection-type items.
3. It has less vagueness and ambiguity than short-answer or supply-type items.

4. It is practically free from response sets; therefore, students do not have the opportunity to favor a particular alternative when they don't know the answers.

5. It is useful as a diagnostic technique.

Limitations:

1. It is only a substitute for more direct means of measurement; only an indicator of the ability of the student to perform in an actual situation.

2. It is not designed to measure all types of behavior. (Multiple choice items are sometimes inappropriate for measuring problem-solving behaviors.)

3. It is difficult to construct. The test-maker must be skilled in writing items that will measure the student's ability to interpret, discriminate, select and evaluate rather than the ability to memorize.

The following principles of test construction, if followed by the test-maker, will ensure fair, good test items:

1. Write test items which will measure <u>specific</u>, <u>significant</u> learning outcomes.

2. Use either a direct question or an incomplete statement as the item stem, whichever seems more appropriate to the presentation of the item.

3. Write items in clear and simple language, with vocabulary kept as simple as possible and at the level appropriate for the students.

4. Base each item on a single, central problem.

5. State the central problem of the item clearly and completely in the stem.

6. In general, include in the stem any words that must otherwise be repeated in each response.

7. Avoid negative statements.

8. Avoid excessive use of non-relevant material.

9. Place the choices at the end of the incomplete statement.

10. Make the responses grammatically consistent with the stem and parallel with one another.

11. Make all responses plausible and attractive to pupils who lack the information and ability tested by the item.

12. Make the responses independent and mutually exclusive.

13. Use the "none-of-these" option with caution.

14. Write distractors (incorrect alternatives) which do not contain clues revealing the correct answer.

15. Decide before writing if the correct or best answer is required, then be sure that there is only one correct answer if that is what is required or that all the answers have some elements of correctness with one best answer (based upon evidence).

16. Compose clear and definite directions for "taking" the test.

Exercise in Constructing Multiple Choice Items
(For Wastewater Treatment Facility Operators)

Directions: Complete the following activities which are designed to provide you with practice in constructing multiple choice items. You have 15 minutes to complete this exercise.

I. Write appropriate stems for each of the following sets of alternatives.

A. (stem:)

1. The oxygen required to sustain aerobic biological oxidation in sewage or waste.
2. The amount of dissolved oxygen required to support life in a stream.
3. The required oxygen level to oxidize toxic metals.
4. The concentration of oxygen required to ensure aerobic biological oxidation of sewage or waste.

B. (stem:)

1. pH of 1
2. pH of 5
3. pH of 7
4. pH of 9
5. pH of 14

II. Write three or more alternatives for each of the following stems.

A. Parshall Flume is used to

1.
2.
3.

B. When computing gas production for the anaerobic digestion system, what is the rate of volatile solids destroyed per cubic foot of gas?

1.

2.

3.

C. What causes the change in pH values in the anaerobic digestion system?

1.

2.

3.

III. Write two multiple choice test items on a subject familiar to you.

A.

1.

2.

3.

B.

1.

2.

3.

Exercise in Constructing Multiple Choice Items
(For Drinking Water Specialists)

Directions: Complete the following activities which are designed to provide you with practice in constructing multiple choice items. You have 15 minutes to complete this exercise.

I. Write appropriate stems for each of the following sets of alternatives.

A. (stem:)

1. Distilling over the interferences and leaving the F^- behind.
2. Distilling over the F^- and leaving the interferences behind.
3. Forming a color with the interferences.

B. (stem:)

1. Became effective in December of 1977.
2. Became effective in December of 1975.
3. Became effective in June of 1977.

II. Write three or more alternatives for each of the following stems.

A. Nitrate can be determined by

1.
2.
3.

B. Samples containing metals are preserved by adding

1.
2.
3.

C. The reason for the MCL on turbidity is because

1.

2.

3.

III. Write two multiple choice test items on a subject familiar to you.

A.

1.

2.

3.

B.

1.

2.

3.

UNIT FIVE: EVALUATION TECHNIQUES
LESSON 2 of 3: CONSTRUCTING WRITTEN TESTS

ASSIGNMENT 5.2 CONSTRUCTING SHORT ANSWER ITEMS

Estimated time: Twenty minutes

This assignment is designed to provide you with a review of the basic techniques for constructing the most useful of the supply-type test items for criterion-referenced tests. The introductory reading reviews the characteristics of short answer items and principles for their construction. An accompanying exercise provides practice in constructing these items.

OBJECTIVE: By the conclusion of this assignment, you will be able to construct short answer items.

EVALUATION: Your performance on the exercise may be reviewed in class at the end of this assignment.

DIRECTIONS:

1. Complete the reading entitled "Introduction to Short Answer Items". This should take no more than 5 minutes to complete.

2. Complete the "Exercise in Constructing Multiple Choice Items". This should require about 15 minutes to complete.

3. Be prepared to participate in a brief discussion or review of your responses to the exercise.

Introduction to Short Answer Items

The short answer test item asks the student to recall information in his own words. It is important to remember, however, that the judgment of acceptable answers should not be influenced by the student's writing skill. Items should be designed so that the acceptable answer can be as brief as possible; a word, phrase, symbol, number, etc. In some cases, the student may have to write a sentence or two as a response.

Compared to multiple choice items, short answer items are easy for the instructor to write, but rather more difficult to "correct". They are suitable for testing a wide range of learning outcomes. Some examples of short answer items are listed below.

1. What is the pH of pure water? 1. _____

2. If acid is present, litmus paper turns 2. _____

3. In the equation $5x + 5 = 15$, what is the value of x? 3. _____

4. State two tests for the presence of acid. 4. _____

Suggestions for writing and correcting short-answer items:

1. Avoid the loose, ambiguous item that does not tie down the answer to one or two specific words or phrases.

2. Do not require more than one or two completions to be made in any one item.

3. For "filling the blank" type items, place the blank near the end of the statement.

4. Avoid cues to the correct answer.

5. In computation problems, specify the degree of accuracy expected.

6. Make the directions and each question explicit.

7. Allow sufficient space for student answers in a column to the right of the questions.

8. Write a scoring key in advance and include all possible acceptable answers for each item.

9. Use a variety of short answer formats. Avoid extensive use of "fill in the blanks" as these often do not test for higher-order learning outcomes.

Exercise in Constructing Short-Answer Items

Directions: Complete the following activities which are designed to provide you with practice in constructing short-answer items. You have 15 minutes to complete this exercise.

I. Convert the following items from multiple choice to short-answer formats. Write your new item in the space provided.

A. If the temperature is allowed to go beyond 180^{0} C

1. the fluoride is not distilled.
2. the iron carries over.
3. sulfate is carried over.

A. (Short-answer version)

B. Which of the following steps must be performed in order to express the value of "total" barium?

1. filtration
2. weighing
3. solubilization or digestion

B. (Short-answer version)

II. Write five short-answer items in the space below. No more than four of these items should be simple "fill-in-the-blank" items. After each item, list all possible correct answers (for use in correcting

responses to the items). Base the items on a subject familiar to you or use material from a subject in this workshop (such as the material on writing objectives).

1.

Possible correct answers:

2.

Possible correct answers:

3.

Possible correct answers:

4.

Possible correct answers:

5.

Possible correct answers:

UNIT FIVE: EVALUATION TECHNIQUES
LESSON 3 of 3: CHECK LISTS AND RATING SCALES

ASSIGNMENT: 5.3: CONSTRUCTING CHECK LISTS AND RATING SCALES

Estimated time: Ten minutes

This assignment is designed to provide some practical experience in constructing check lists and rating scales. You have ten minutes to complete the following exercises after which you will exchange your work with another participant for review.

OBJECTIVE: By the conclusion of this assignment you will be able to construct check lists and rating scales.

EVALUATION: Your performance on the exercise will be reviewed by another participant.

DIRECTIONS:
1. Complete the following two activities using your notes from the lecture on rating scales and check lists. You have approximately ten minutes to complete these activities.

2. Exchange your work with that of another participant in the workshop. Review his/her items for clarity and completeness. Discuss problem areas with the participant.

3. Check with the instructor regarding any problems or questions that arise.

1. Develop two items for a check list that could be used to evaluate good driving habits.

2. Develop two items for a rating scale that could be used to evaluate good driving habits.

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT SIX
INSTRUCTIONAL METHODS AND MEDIA

Estimated time for unit - Three hours

The CONTENT of this unit:

This unit introduces two activities necessary to design instruction: selection of instructional methods and media. The Lesson Planning Form, the Instructional Methods Selection Table, and the Media Selection Table are used to select sequences of instructional methods and media that are appropriate for the type and level of behavior specified in the objective. The unit concludes with an application exercise.

The OBJECTIVE of this unit:

In this unit you will learn to select instructional methods using the Lesson Planning Form and Instructional Methods Selection Table. You will then learn how to select appropriate media using the Media Selection Table.

The PURPOSE of this unit:

Effective instruction requires more than just specifying objectives and listing content topics. A useful instructional presentation includes instructional methods and media that have been selected to be consistent with the level of behavior specified by objectives.

The RESOURCES for this unit:

1. Content Summary
2. Instructional Methods Selection Table
3. Media Selection Table
4. Assignment 6.1 Selecting Instructional Methods and Media

UNIT SIX: INSTRUCTIONAL METHODS AND MEDIA
CONTENT SUMMARY

Development Decisions

Designing and developing instruction involves a series of decisions which are reflected on the Instructional Package Worksheet.

-identifying and analyzing a problem
-analyzing jobs and tasks
-specifying instructional objectives
-selecting evaluation strategies
-selecting instructional methods
-determining appropriate media
-identifying available media
-specifying final instructional approach

Four Types of Methods

I. The Lecture (Method #1)

A. Definition - uninterrupted speech by which one presents information to others

B. Characteristics of a Good Lecture

1. The lecturer has good public speaking skills

2. The presentation is

a. brief - usually no more than 15-20 minutes of uninterrupted speech; a lecture should not strain normal attention span

b. organized

i) the introduction
(a) establishes rapport between lecturer and learners
(b) defines the purpose of the lecture, gains learners' attention, and motivates them to remain attentive
(c) outlines the major points of the lecture
(d) defines the objectives of the lecture

ii) the body
(a) uses a simple-to-complex structure for presenting the content
(b) aims toward specific objectives
(c) provides opportunities for questioning
(d) allows for practice of knowledge

iii) the conclusion
(a) reviews and summarizes main points
(b) opens opportunity for student responses
(c) provides directions to the next activity

c. accompanied by media (when appropriate)

i) highlighting - visual accompaniments such as outlines, graphics, pictures - reinforce content during the lecture

ii) student handouts - "take-homes" such as outlines, procedural guidelines, etc. - serve as a personal employee manual for on-the-job use

C. Advantages

1. Presents large amounts of information from many or from hard-to-get sources in short amount of time

2. Gives instructor control over the kind of information and organization presented

3. Provides the most efficient way to introduce and to summarize a learning experience

D. Disadvantages

1. Over-stresses acquisition of facts

2. Can make learners into passive, dependent receivers of information

3. Is instructor-paced

4. Is often too long

5. Is often over-used or misused

6. Is not for teaching "how to" (procedures)

7. Depends for success on instructor's public-speaking ability

II. Demonstration (Method #2)

A. Definition - showing, as opposed to telling, how to do something by manipulating appropriate materials and equipment

B. Characteristics of a Good Demonstration

1. The instructor prepares site and materials

a. on-location or simulated site is chosen and prepared for maximum effectiveness and visibility to all learners

b. materials and equipment obtained and tested by working through demonstration

c. setup allows everyone to see demonstration

d. media/handouts prepared to complement demonstration - i.e., steps outlined, decision points and criteria defined, "success" described in terms of predefined criteria

2. The instructor prepares for the students

a. necessary orientation information developed

b. mini-lectures for introducing and summarizing the procedure prepared

c. frequent opportunities provided to ask questions

d. frequent checks to ensure student understanding

e. opportunities to practice the procedure

C. Advantages

1. Gives on-the-job experience

2. Allows learners to develop and practice skills under supervision

D. Disadvantages

1. Not useful alone; must be prepared for and summarized through lecture or reading

2. Large groups of learners require much time for practice in order to be effective

3. Useful only for fixed-step procedures, not for creative problem solving

4. Requires equipment, materials, often site visits

III. Guided Discussion (Method #3)

A. Definition - a sharing of ideas and opinions in order to arrive at a mutually acceptable decision or solution to a problem

B. Characteristics of a Good Discussion

1. Not a bull session - topics and objectives must be carefully prepared and purpose explicitly defined so that group will know when discussion should end

2. Groups should be small enough to allow everyone to participate and large enough to avoid polarization or domination by a few

3. Discussion leader

a. initiates discussion by stating topics, objectives, guidelines (rules for participating, parameters of discussion)

b. coordinates discussion by summarizing ideas and establishing relationships among ideas

c. orients discussion by pulling discussion back to topic; avoids playing expert and giving lectures

d. encourages participation by warmth, non-critical analysis of contributions, questioning silent members in non-threatening way

e. harmonizes the group by dealing with personal confrontations and disagreements and arbitrating as necessary

f. gate-keeps by preventing anyone from dominating the group

4. Participants

a. participate - purpose is to share ideas in order to develop solution to problem

b. remain non-critical and objective - avoid personal attacks and emotional analyses like "that's stupid"

c. stick to the topic

d. avoid private discussions and share ideas with whole group

e. direct comments and questions to group rather than to leader

f. accept leader as arbitrator of group

5. Physical environment is arranged to facilitate discussion by ensuring eye contact among all participants

C. Advantages

1. Allows all members of group opportunity to share ideas

2. Provides for mutual solving of a problem and practice in ways of solving problems

D. Disadvantages

1. Can be dominated by an individual or faction

2. Can degenerate into an exchange of abuse

3. Can bog down in extended, uncomfortable silence or irrelevancies

4. Can be a front for leader-provided lectures

5. Can be misused (not suitable for communicating factual information or teaching procedures)

IV. Adaptive Instruction (Method #4)

A. Definition - to adapt instruction to individual needs, goals, learning materials and/or instructional methods and techniques are especially chosen to suit a particular student or group of students

Types of Adaptive Instruction - individualized learning packages, assignments, tutorials

B. Characteristics of Good Adaptive Instruction

1. Characteristics of effective individualized learning packages

a. provides all the information and materials learner needs to know on his/her own

b. provides for practice and feedback

c. is structured properly (orienting overview, body with logical learning steps, summarizing review)

d. meets individual needs of learners

2. Characteristics of effective assignments

   a. application oriented - allows students to apply knowledge and skills in new or unfamiliar contexts

   b. allows for choice - provides options so that the students can choose among alternative assignments, contexts, or subjects

   c. builds skills in specific steps from simplest to most complex

   d. provides feedback reinforcement

3. Characteristics of effective tutorials

   a. is a one-to-one session between tutor and learner (tutor need not be the instructor)

   b. has problem-solving orientation using stages of diagnosis and remedy

   c. builds skills in specific steps

   d. tutor guides learner to discover answers - does not lecture at learner

   e. session is problem-specific and ends when solution is discovered

C. Advantages

1. Responsive to individual needs

2. Allows for learner pacing and repetition as desired

3. Individualized learning packages can be given out when it is difficult to organize a class or too few students or no instructor available

4. Tutorials can be used to help several learners with difficult problems in a short space of time

D. Disadvantages

1. Instructor-made individualized learning packages are expensive to prepare

2. Not suitable for complex or complicated subject matter

3. Not useful for teaching procedures that require equipment or complicated materials

4. Does not allow for exchange of ideas and opinions - basically a lonely method of learning

INSTRUCTIONAL METHODS SELECTION TABLE

Types of Behavior \ Instructional Method	LECTURE	DEMONSTRATION	GUIDED DISCUSSION	ADAPTIVE INSTRUCTION*
COGNITIVE, Knowledge	Appropriate for teaching facts	Generally not useful	Generally not useful	Useful and appropriate for conveying factual information
COGNITIVE, Comprehension	Appropriate	Useful as a supportive method to reinforce concept-using	Generally not useful	Appropriate
COGNITIVE, Application	Appropriate for initial presentation of rules	Most appropriate method for teaching rule-using	Generally not useful	Appropriate for initial presentation of rules
COGNITIVE, Problem-Solving	Generally not useful	Useful for problem-solving instruction	Useful and appropriate for developing problem-solving skills	Exercises are useful for teaching problem-solving
PSYCHOMOTOR	Useful only in support of a demonstration	Live or simulated demonstrations are the most effective method for teaching motor skills	Generally not useful	Useful only in support of a demonstration
AFFECTIVE	Usually not effective for motivating trainees or changing attitudes about something	Modelling and simulations are useful for forming attitudes	Group activities such as role-playing are often useful for attitude formation	Generally not useful

*Individualized Learning Packages; Assignments; Tutorials

MEDIA SELECTION TABLE

Categories of Media

Types of Behavior	OBJECTS	STILL PICTURES	MOVING PICTURES	AUDIO MEDIA	WRITTEN MATERIALS
COGNITIVE Knowledge Comprehension Application Problem-Solving	Especially useful with demonstrations. Can be used to teach -recognition and discrimination -rules, principles or sequential steps.	Very useful for all levels of cognitive instruction. Can highlight stress concepts by displaying words, lists of steps, pictures and pictorial segments. Can provide visual cues.	Useful for showing content not otherwise easily brought into the training situation. Usually too costly for presenting still visuals and/or narrative audio.	May have their greatest use when in conjunction with printed matter or projected visuals. Useful if sounds of machines, alarms, etc. must be learned. Inexpensive.	Excellent media for all levels of cognitive instruction. Relatively inexpensive, printed materials allow for self-pacing. Can be used effectively with still pictures and audio materials.
PSYCHOMOTOR	Useful for teaching and trainee practice of performance in manipulating tools and equipment. Especially appropriate for on-the-job training. People can be used to demonstrate physical actions.	Little application. Can portray static positions of moving persons or objects.	Very useful. Can be used to: -model skills requiring motion -slow motion for close examination -provide visual feedback of student performance -demonstrate processes which take place over an extended time period.	Recorded audio materials generally useful in training only when demonstrating speech or hearing-related skills.	Limited application. since motion is difficult to represent. One important use is procedure guides or checklists for skills performance.
AFFECTIVE	Limited application. May be useful if the object is the focus of the desired attitude formation.	Limited application. Slides in combination with audio materials may influence attitude formation.	Excellent for influencing attitudes. Special effects and other visual techniques are especially useful for presenting affective material.	Limited application. Possibly useful for establishing moods or attitudes with background music, special sounds, or unique narration. May be used with slides to influence attitude formation.	Very little application for training materials.

UNIT SIX: INSTRUCTIONAL DESIGN
LESSON 4 of 4: EXERCISE IN SELECTING METHODS AND MEDIA

ASSIGNMENT 6.1: SELECTING INSTRUCTIONAL METHODS AND MEDIA

Estimated time: Sixty minutes

This assignment is designed to give you practice in selecting instructional methods and media and planning a lesson. You will use the Instructional Methods Selection Table, the Media Selection Table and the Lesson Planning Form to design a lesson on a step of the suspended solids test. A Problem Scenario and completed Task Detailing Sheet are included as resources. Your task is to select, from the Task Detailing Sheet, one step that needs to be taught (see column D on the Task Detailing Sheet), and to complete a Lesson Planning Form for a lesson on that step. You will specify the instructional objective, entering competencies, and evaluation activity, and use the tables provided to choose the most appropriate method and media for use in instruction. You will have approximately 45 minutes in which to work. The remaining 15 minutes will be spent in a discussion of any problems or concerns involved in using the Selection Tables and completing the Lesson Planning Form.

Objective: By the conclusion of this assignment, you will be able to plan a lesson, using the Instructional Methods Selection Table, the Media Selection Table and Lesson Planning Form.

Evaluation: Participant review and discussion of completed Lesson Plans will serve as the evaluation activity for this assignment.

Directions: 1. Complete the Exercise described on the following pages. Use the Task Detailing Sheet and Lesson Planning Form provided. This task should take approximately 45 minutes.
2. Discuss the completed Forms with fellow participants. This task should take approximately 15 minutes.

ASSIGNMENT 6.1

EXERCISE DESCRIPTION

You have been asked to analyze a problem about inconsistent suspended solids data collected for several weeks. The nature of the problem is explained in the Problem Scenario, which is attached. After analyzing the problem and finding it to be amenable to a training solution, you have completed the Task Detailing Sheet, which is also included here. Your task now is to plan a lesson on one of the steps of the suspended solids test. Use the Lesson Planning Form, the Instructional Methods Selection Table and the Media Selection Table to plan instruction on one step of the task listed on the Task Detailing Sheet. Record your decisions on the Lesson Planning Form. Be prepared to explain and justify all decisions during a discussion which completes the assignment.

Problem Scenario

You are a trainer in a regional office of a "Water Management Bureau". Your supervisor has called you into a meeting to give you the following information:

> Spot inspections of the data for effluents in a number of wastewater treatment plants revealed that the suspended solids data was not consistent with other effluent data during the past six months. Preliminary investigation showed that:
>
> -suspended solids data was consistent with other effluent data for the same seasonal periods at earlier dates
>
> -the recent plant operating conditions were comparable to those in the earlier, same seasonal periods when the effluent data was consistent

Your supervisor has given the project to you. You are directed to investigate further to determine what the problem is and if training is required to solve it.

You visit the plants in question and learn that new personnel (hired within the last six months) conduct the suspended solids tests. A few of the newly-hired work for experienced supervisors but only meet with the supervisor for very limited periods of time because of twenty-four hour operations and shift rotations. At the other plants, no one except the new employee is experienced in conducting the suspended solids test.

TASK DETAILING SHEET

A. Write Job Title Chemist, Wastewater Treatment Plant

B. Write Task Perform suspended solids test

Complete steps C - F in the space below.

C. List the specific steps required to perform the task.
D. Check each step which needs to be taught.
E. Indicate whether the checked steps primarily involve cognitive, affective, or psychomotor behavior.
F. For a cognitive behavior, indicate the appropriate level of performance:
Knowledge - ability to recall information or procedures
Comprehension - ability to explain information or procedures
Application - ability to use information or procedures to do something
Problem Solving - ability to develop new information or procedures

C Steps Required to Perform Task	D Needs to be Taught	E Type of Behavior: Cognitive, Affective, Psychomotor	F Level of Cognitive Behavior: Know., Comp., Appl., P. S.
(1) Gather equipment		Cognitive	knowledge
(2) Prepare filter	✓	Cognitive	application
(3) Measure sample	✓	Cognitive	knowledge
(4) Filter sample		Cognitive	knowledge
(5) Dry residue		Cognitive	knowledge
(6) Allow residue to cool		Cognitive	knowledge
(7) Weigh residue & filter	✓	Cognitive	application
(8) Record weight of residue		Cognitive	knowledge
(9) Repeat steps 5, 6, 7		Cognitive	knowledge
(10) Check consistancy of weight of residue and filter	✓	Cognitive	application
(11) Calculate weight of residue	✓	Cognitive	application
(12) Record weight of residue		Cognitive	knowledge

LESSON PLANNING FORM

Job Title Chemist: Wastewater Treatment Plant Task perform S.S. test

Step _____

Type and Level of Behavior _____
(as appropriate)

1) Instructional Objective:

Audience _____

Behavior _____

_____

Conditions _____

_____

Acceptable Performance _____

_____

2) Entering Competencies: _____

_____

3) Evaluation Activities: _____

_____

4) Instructional Methods: *Using the Instructional Methods Selection Table for guidance, choose the method or methods most suitable for reaching the objective and describe how it will be used.*

METHOD(s) _____

_____

_____

5) Instructional Media. *Use the Media Selection Table to guide your choice of media for use in instruction. List all that apply.*

Appropriate Category of Media	Specific Medium & Title Available
_____	_____
_____	_____
_____	_____

6) Sequence of Instructional Activities. *Outline the specific activities which comprise the instructional approach.*

1. _____
2. _____
3. _____

LESSON PLANNING FORM

6) Sequence of Instructional Activities. (Continued)

4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

BASIC INSTRUCTIONAL TECHNOLOGY
PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT SEVEN
LESSON PLANNING

Estimated time for unit - Three hours thirty minutes

The CONTENT of this unit:

This unit completes basic instruction in the process of designing and planning a lesson. Through a procedure for filling out the Instructional Package Worksheet, you will learn how to translate decisions made earlier into a plan for conducting a lesson. In addition, you will learn to apply a set of rules for planning effective instruction. An exercise in planning a lesson, using the Task Detailing Sheet, Lesson Planning Form, and Instructional Package Worksheet, will be followed by a brief discussion of additional considerations in planning to deliver instruction.

The OBJECTIVES of this unit:

In this unit you will learn to:

-list the activities involved in planning a lesson
-define and give an example of each of the nine rules for effective instruction
-plan a lesson that incorporates the nine rules, using the Instructional Package Worksheet format

The PURPOSE of this unit:

Planning how to conduct a lesson is the final step in the design process. The task of planning thus pulls together such earlier activities as specifying objectives, identifying evaluation strategies, and selecting methods; the outcome of these activities is the Instructional Package Worksheet. By completing the Instructional Package Worksheet in accordance with specific rules for effective instruction, the instructor prepares a detailed plan for the conduct of the lesson.

The RESOURCES for this unit:

1. Content Summary
2. Assignment 7.1: Principles of Instruction
3. Assignment 7.2: Exercise in Planning a Lesson

UNIT SEVEN: LESSON PLANNING
CONTENT SUMMARY

Lesson Planning

- -Converting instructional design decisions into a plan for teaching
- -The role of the Instructional Package Worksheet (IPW)
- -Instructional methods and the instructional approach; using the Task Detailing Sheet and Lesson Planning Forms to complete an Instructional Package Worksheet

Nine Rules for Good Instruction

- -Begin with an explanation of why the new skill or knowledge is important
- -Include a precise description of what the learner will be able to do after s/he has learned
- -Ensure that the learner is ready to begin learning
- -Move from the whole to the part and from the general statement to the specific detail
- -Provide a variety of learning experiences
- -Include samples
- -Include opportunities for learners to practice what they are learning
- -Provide ongoing feedback so learners know how well they are learning
- -Consider the type and level of behavior specified in the instructional objective

Completing the Instructional Package Worksheet

- -State the objective
- -Give a justification for the objective
- -Specify an evaluation strategy
- -Identify support materials for teaching
- -Specify the instructional approach

Exercise in Planning a Lesson

LESSON SEVEN: PLANNING A LESSON
LESSON 2 of 5: PRINCIPLES OF INSTRUCTION

ASSIGNMENT 7.1: PRINCIPLES OF INSTRUCTION

Estimated time: Seventy-five minutes

This assignment introduces you to nine principles for planning effective instruction. Each principle is explained and illustrated. An exercise accompanies each principle so you can try out your understanding of the principle as you learn it. Answers to the exercises are provided for you to check your own answers. For each principle, the explanation, the example, and the exercise appear together. Answers to all exercises for all nine principles are at the end of the lesson.

Some exercises have no single correct answer but rather a range of answers are correct. In the answer key, you will find a suggested or representative answer. Your answer should be similar to the one suggested. If you miss more than one question in an exercise, review the principle, the explanation, and the example. When you understand your mistake, go on to the next principle. Ask your instructor if you don't understand an answer or if you have a question about the principle.

As you read, you will notice that some of the rules appear to present redundant information. This repetition is not accidental; it occurs for two reasons. First, one of the most useful devices for facilitating learning is repetition; repeating important information serves to strengthen learning. Second, the purpose of this lesson is to pull together ideas from the first six units into a single set of rules which you should follow as you plan a lesson. Therefore, the repetition serves to emphasize the importance of these rules as the basic guidelines for presenting a lesson effectively.

OBJECTIVE: After completing this assignment, you will be able to define and give an example of the application of each of the nine rules for effective instruction.

EVALUATION: At the end of one hour, you will have completed a post-test on the content. The questions on the post-test will be very similar to those you have already encountered in the exercises. When you have completed the post-test, you will exchange papers with a fellow participant and discuss your answers.

DIRECTIONS:
1. Complete the readings, exercises and post-test on the following pages. This task should take approximately 60 minutes.
2. Discuss the post-test. This task should take approximately 15 minutes.

RULE #1: GOOD INSTRUCTION BEGINS WITH AN EXPLANATION OF WHY THE NEW SKILL OR KNOWLEDGE IS IMPORTANT

Explanation: When learners are made aware of the relevance or importance of the new knowledge or skill, there will be greater motivation for learning.

Application: Giving learners reasons for learning may involve telling them that the new skill is required for a higher-level position, or that the new knowledge will help them to perform present job tasks more efficiently. The reason motivates trainees to learn.

Example: The average eight-year-old boy may have no interest in learning arithmetic. However, if the child discovers that, in order to obtain a paper route, he must be able to make change quickly and correctly, his interest in learning arithmetic will increase. Obtaining a paper route serves as motivation for learning arithmetic.

EXERCISE #1: Place an x next to each statement that is a good example of an instructor's explanation for a lesson.

____1. Learning to balance these figures is the first step in learning the bookkeeping system. Clerks on the next three job levels above this one must know this bookkeeping system.

____2. Your job may never require you to run this test, but the procedure is quite interesting.

____3. This material is required of all students in this course.

____4. A knowledge of FORTRAN computer language is essential in programming this computer. You will probably use FORTRAN many times each day in your job.

____5. Since many of your co-workers on this project do not speak English, the company is offering this course in conversational French to help you communicate with your co-workers.

RULE #2: GOOD INSTRUCTION INCLUDES A PRECISE DESCRIPTION OF WHAT THE LEARNER WILL BE ABLE TO DO AFTER S/HE HAS LEARNED.

Explanation: Trainees need to know what the goal or object of instruction is, so they can separate what they must know from what is nice to know. Specifying the skill or knowledge that will result from learning is one way of informing trainees of the goal.

Application: Instructional objectives give trainees both a goal to work toward and a standard against which they can judge their ability. Specifying instructional objectives also aids the instructor in directing the instruction toward the specific goals.

Example: Participants in the Basic Instructional Technology Workshop have been told that one objective of the workshop is that they be able to use the nine rules for effective instruction to plan a lesson. The participants know that they must apply the nine rules; merely stating the rules or giving explanations for them is not sufficient. The instructional objective specifies a precise goal for learning.

EXERCISE #2: Put an x next to each statement which provides a clear goal for learners.

____1. After completing this lesson, you will know about nine rules for planning instruction.

____2. By the end of this unit, you will be able to test water samples for the presence of mercury, using standard equipment.

____3. When you finish this unit, you will understand why instructional objectives must be specified.

____4. When they have completed the basic workshop, participants will be able to plan a lesson.

____5. The purpose of this lesson is to teach you about evaluation.

RULE #3: GOOD INSTRUCTION ENSURES THAT THE LEARNER IS READY TO BEGIN LEARNING.

Explanation: Learners must possess certain basic skills and knowledge before they can successfully learn more complex things. The basic abilities are thus prerequisites for the complex abilities. The instructor must make certain that learners have these prerequisite abilities and are therefore ready to begin learning more complex skills and knowledge.

Application: You can determine whether trainees are ready to begin learning by evaluating the degree to which they possess prerequisite abilities. The evaluation can be highly formal, such as a written test, or highly informal, such as a brief discussion. Trainees who lack prerequisite skills or knowledge may need to be provided with instruction on the abilities they lack before they can begin to learn new or more complex abilities.

Example: Before your instructor can help you learn how to select instructional methods, s/he must be certain that you know how to specify instructional objectives and classify instructional resources. Therefore, the prerequisite abilities for learning to select methods are writing objectives and classifying resources. To determine whether the participants are ready to begin learning the procedure for method selection, the instructor may give a quiz on the prerequisite abilities. Those who do not pass the quiz will be asked to study material on the prerequisite skills.

EXERCISE #3: For each of the following tasks, identify two prerequisite abilities which learners must have before they can learn the task.

____1. Select an evaluation strategy for a lesson.

____2. Determine the type of behavior specified in an objective.

____3. Perform a task analysis.

RULE #4: GOOD INSTRUCTION MOVES FROM THE WHOLE TO THE PART AND FROM THE GENERAL STATEMENT TO THE SPECIFIC DETAIL

Explanation: Learning requires understanding. A learner cannot understand when only a part of an idea or a single detail is presented. Learners must have access to the whole concept or procedure or rule before they can understand the parts.

Application: Begin each lesson by stating the whole concept, rule, or procedure to be learned. Then present specific details, steps, and illustrations. Do not give examples until after the whole idea has been taught.

Example: In Unit One of the Basic Workshop, you were shown a general five-part model of the procedure for designing instruction. That model represents the whole process you will learn during the workshop. Each of the next six units represents a part of that whole process; for example, the first part you studied was problem definition. Within each unit, individual lessons present specific details of the process. For example, one detail involves using the Problems Definition Worksheet. Thus, the entire workshop has been designed in terms of a general-to-specific sequence.

EXERCISE #4: You have been asked to teach a lesson on selecting instructional methods. Listed below are some topics you wish to include in the lesson. For each pair of topics, put an x beside the topic you would teach first.

____1. Definition of "instructional method"

____2. Characteristics of a lecture

____3. A procedure for classifying instructional resources

____4. Still visual displays

____5. Use of the Instructional Methods Selection Table

____6. Use of the Lesson Planning Form

RULE #5: GOOD INSTRUCTION PROVIDES A VARIETY OF LEARNING EXPERIENCES.

Explanation: Some people learn by listening to lectures; some prefer to discuss ideas and ask questions; still others need to see visual representations such as diagrams and pictures. People learn differently.

Application: A good instructor considers these differences and provides instruction in a variety of ways. A lecture can be supplemented with visuals such as charts and graphs. A reading can be followed by a discussion. The repetition that occurs when several methods are combined is important. Repetition leads to better and more lasting retention.

Example: To teach participants how to write instructional objectives, an instructor decides to use a lecture. However, since a variety of instructional methods provides important repetition, the instructor also plans to use overhead transparencies and handouts which diagram the process of writing objectives. The instructor also plans to hold a discussion on the difficulties in writing objectives. Finally, the instructor will assign a reading to reinforce the other presentations. By using a variety of methods, the instructor makes certain that the needs of all learners are met.

EXERCISE #5: List 2-3 ways in which an instructor might provide variety during a lesson on each of the following three topics.

____1. Using an analytical balance

____2. Performing a task analysis

____3. Setting up equipment for a chemical test

RULE #6: GOOD INSTRUCTION INCLUDES EXAMPLES.

Explanation: Examples are concrete and specific illustrations of general ideas. They connect abstract words to the real world. Examples show learners how rules and procedures work.

Application: Examples include demonstrations of procedures, applications of formulas and rules, and illustrations of concepts. Examples reveal how procedural steps should be carried out and how formulas and rules should be used. To be most useful, examples should move from easy to difficult. Whenever possible, more than one example should be used to teach a single procedure or rule or concept.

Example: The design of this assignment involved the application of the rule for including examples. After each rule for good instruction is presented, an example is given so that the participants can see how to implement the rule. The example makes concrete and specific the general statement of the rule.

EXERCISE #6: Identify four instances of the uses of examples in teaching the concepts of this workshop.

1. _____

2. _____

3. _____

4. _____

RULE #7: GOOD INSTRUCTION INCLUDES OPPORTUNITIES FOR LEARNERS TO PRACTICE WHAT THEY ARE LEARNING

Explanation: Practice opportunities allow learners to try out new abilities and to discover what they don't understand. Practice aids both in increasing retention and in transferring the new skill or knowledge from the classroom to the real world.

Application: Practice opportunities should be included for each separate concept or rule or procedure being taught. Frequent opportunities should be provided for practice during instruction. Several short sessions of increasing levels of difficulty are far more effective than a single lengthy session at the end of a lesson. Learners can gain practice by discussion of ideas, using formulas and rules to solve problems, and carrying out procedures.

Example: The design of this reading illustrates the rule that good instruction includes opportunities for practice. As each rule is presented and explained, you are given an opportunity to try out your new knowledge. An exercise allows you to practice using the rule to determine how well you understand the rule. Several short sessions are provided, one for each rule.

EXERCISE #7: As a wastewater treatment plant chemist, one of your duties involves teaching technicians to perform routine chemical tests. Each of the two paragraphs below describes an approach to teaching a test procedure. Put an x beside the paragraph that describes the more effective use of practice.

____1. The instructor lists the steps in the procedure and then demonstrates the procedure. Next, the instructor asks one trainee to list, in order, the steps involved. Then, the instructor demonstrates the procedure again, commenting on important concerns or cautions associated with each step. Finally, the instructor asks each trainee to carry out the procedure on a wastewater sample.

____2. The instructor lists the steps in the procedure. As he demonstrates each step, he asks a trainee to state what is involved in the step. Next, the instructor asks one trainee to demonstrate the procedure under the direction and guidance of the other trainees. Then trainees work in pairs to criticize each other as they carry out the procedure. Finally, each trainee is given three wastewater samples and asked to perform the test and report results for each sample.

RULE #8: GOOD INSTRUCTION PROVIDES ONGOING FEEDBACK SO LEARNERS KNOW HOW WELL THEY ARE LEARNING.

Explanation: Feedback is knowledge of results. Feedback can be as simple as "Right/Wrong" response from the instructor. Or it can involve detailed explanations of why answers are wrong and directions for correcting the answers. Feedback serves two important purposes. First, it tells the learner how well s/he is doing so that the learner knows how to correct errors and increase learning. Second, feedback motivates the learner to try again.

Application: Feedback should be both explanatory and motivating. You should provide both correct answers and encouragement. Praise is an important part of feedback; it can take the form of a compliment as well as a high score on an exercise or test. Feedback should also be provided frequently. Each exercise or activity should include a feedback component. Most important, feedback should be constructive; it must never attack a learner personally and it must be specific in identifying errors and suggesting solutions.

Example: Robert's mother is teaching him to bake bread. She describes the process, gives Robert a receipe, and demonstrates the process. Then she lets Robert try. When Robert adds the yeast to cold water, she tells him that the yeast will not develop and shows him how warm the water should be. When Robert kneads the dough, she compliments him on his firm touch but tells him to include more time for kneading. And when the bread is out of the oven and ready to eat, she proudly serves it to the family. She has demonstrated the process of providing ongoing feedback so that Robert can correct his mistakes and feel confident about his successes.

EXERCISE #8: Place an x next to each example of effective feedback.

____1. Your test score was 70 out of a possible 80. Good work!

____2. You incorrectly stated one part of the objective; find your error and correct it.

____3. That's a stupid comment!

____4. You seem to be having trouble understanding the concept of evaluation. Reread Unit Five and mark the parts you don't understand; then come talk with me.

____5. You are holding that beaker wrong; that's why you are having trouble seeing the sediment.

RULE #9: GOOD INSTRUCTION CONSIDERS THE TYPE AND LEVEL OF BEHAVIOR SPECIFIED IN THE INSTRUCTIONAL OBJECTIVE.

Explanation: Instruction must be directed toward the type and level of behavior specified by the objective. Type and level of behavior in the objective determine the kinds of learning experiences trainees must have in order to perform as the objective specifies.

Application: Psychomotor objectives require instruction in physical (motor) skills; verbal descriptions of physical movements are not sufficient. The learner must be able to practice the type of performance that s/he will have to demonstrate during the evaluation.

Affective objectives necessitate experiences which provide models for the desired behavior. Learners must see others demonstrate desired attitudes and must have opportunities to practice the behaviors on which they will be evaluated.

Different levels of cognitive objectives require different kinds of learning experiences. To perform at the Comprehension level, the learner must have access to verbal information and practice in stating that information. To perform at the Comprehension level, the learner must have instruction and practice in explaining, defining, and classifying. Application-level performance is developed through experiences involving using rules and formulas and carrying out procedures. Problem-solving abilities are developed through exposure to problem situations which allow learners to practice generating and testing solutions. The kind of instruction learners receive determines the kind of performance they will be capable of giving.

Example: To teach participants how to write instructional objectives, the instructor provides several types of learning experiences. He defines the concept "objective", shows examples of properly written objectives, describes the procedure for specifying the four components, and provides participants with practice in writing the objectives. Since the level of performance specified in the objective is at the Application level, the instructor knows that participants must have training and practice in applying the formula and writing sample objectives.

EXERCISE #9: For each of the following objectives, name the most important kind of learning experience that trainees would need in order to be able to perform the type and level of behavior specified in the objective.

1. Uses an analytic balance to weigh a substance.

2. Explains the importance of specifying an acceptable performance level in an instructional objective.

3. Types a report from a written copy.

ANSWER KEY

EXERCISE #1: Place an x next to each statement that is a good example of an instructor's explanation for a lesson.

__x__ 1. Learning to balance these figures is the first step in learning the bookkeeping system. Clerks on the next three job levels above this one must know this bookkeeping system.

____ 2. Your job may never require you to run this test, but the procedure is quite interesting.

____ 3. This material is required of all students in this course.

__x__ 4. A knowledge of FORTRAN computer language is essential in programming this computer. You will probably use FORTRAN many times each day in your job.

__x__ 5. Since many of your co-workers on this project do not speak English, the company is offering this course in conversational French to help you communicate with your co-workers.

EXERCISE #2: Put an x next to each statement which provides a clear goal for learners.

____ 1. After completing this lesson, you will know about nine rules for planning instruction.

__x__ 2. By the end of this unit, you will be able to test water samples for the presence of mercury, using standard equipment.

__x__ 3. When you finish this unit, you will understand why instructional objectives must be specified.

__x__ 4. When they have completed the basic workshop, participants will be able to plan a lesson.

____ 5. The purpose of this lesson is to teach you about evaluation.

EXERCISE #3: Suggested responses

1. Select an evaluation strategy for a lesson.

   explain the concept of evaluation
   identify kinds of evaluation strategies

2. Determine the type of behavior specified in an objective.

   define types of behavior
   explain the concept of "objective"

3. Perform a task analysis.

distinguish between a task and a job
identify steps in a task

EXERCISE #4: You have been asked to teach a lesson on selecting instructional methods. Listed below are some topics you wish to include in the lesson. For each pair of topics, put an x beside the topic you would teach first.

__x__ 1. Definition of "instructional method"
____ 2. Characteristics of a lecture

__x__ 3. A procedure for classifying instructional resources
____ 4. Still visual displays

__x__ 5. Use of the Instructional Methods Selection Table
____ 6. Use of the Lesson Planning Form

EXERCISE #5: List 2-3 ways in which an instructor might provide variety during a lesson on each of following three topics.

1. Using an analytical balance

lecture or film
demonstration

2. Performing a task analysis

lecture demonstration
individualized learning package

3. Setting up equipment for a chemical test

film reading demonstration

EXERCISE #6: Identify four instances of the uses of examples in teaching the concepts of this workshop.

1. all demonstrations are examples
2. each rule in this assignment has an example
3. the simulation exercise is an example
4. the exercises in this assignment contain examples

EXERCISE #7: As a wastewater treatment plant chemist, one of your duties involves teaching technicians to perform routine chemical tests. Each of the two paragraphs below describes an approach to teaching a test procedure. Put an x beside the paragraph that describes the more effective use of practice.

___1. The instructor lists the steps in the procedure and then demonstrates the procedure. Next, the instructor asks one trainee to list, in order, the steps involved. Then, the instructor demonstrates the procedure again, commenting on important concerns or cautions associated with each step. Finally, the instructor asks each trainee to carry out the procedure on a wastewater sample.

__x 2. The instructor lists the steps in the procedure. As he demonstrates each step, he asks a trainee to state what is involved in the step. Next, the instructor asks one trainee to demonstrate the procedure under the direction and guidance of the other trainees. Then trainees work in pairs to criticize each other as they carry out the procedure. Finally each trainee is given three wastewater samples and asked to perform the test and report results for each sample.

EXERCISE #8: Place an x next to each example of effective feedback.

__x 1. Your test score was 70 out of a possible 80. Good work!

___2. You incorrectly stated one part of the objective; find your error and correct it.

___3. That's a stupid comment!

__x 4. You seem to be having trouble understanding the concept of evaluation. Reread Unit Five and mark the parts you don't understand; then come talk with me.

___5. You are holding that beaker wrong; that's why you are having trouble seeing the sediment.

EXERCISE #9: For each of the following objectives, name the most important kind of learning experience that trainees would need in order to be able to perform the type and level of behavior specified in the objective.

1. Uses an analytic balance to weigh a substance.

   practice in following the procedure

2. Explains the importance of specifying an acceptable performance level in an instructional objective.

   oral or written practice in explaining

3. Types a report from a written copy.

   practice in using typewriter

Post-test

You have been asked to teach a lesson on writing behavioral objectives. The purpose of the lesson is to help students learn how to identify the type and level of behavior for each objective. All the following questions involve applications of the nine rules to the design of this lesson.

1. State two instructional objectives for the lesson.

2. Put an x beside the statement which best explains why learners should master the objective.

____a. the training supervisor always wants to see lesson objectives

____b. objectives tell students what they will be able to do when they have learned

____c. objective-writing is a fascinating skill to study

3. List at least three prerequisites for this lesson.

4. a. List at least four instructional methods that can be used to teach the lesson.

   b. Briefly describe how you would provide examples, practice opportunities, and feedback.

5. Briefly explain how you would prove that the lesson was appropriate for the domain and the level of performance specified in the objective.

UNIT SEVEN: LESSON PLANNING
LESSON 4 of 5: EXERCISE IN PLANNING A LESSON

ASSIGNMENT 7.2: EXERCISE IN PLANNING A LESSON

Estimated time: Sixty minutes

This assignment is designed to give you practice in specifying instructional activities and identifying instructional resources for a single lesson. Using the Task Detailing Sheet and Lesson Planning Form completed in Unit Six, Lesson 4, you will complete an Instructional Package Worksheet (IPW) for your lesson on a suspended solids test step. You will have approximately 45 minutes for this task. The remaining 15 minutes will be spent in a discussion of any problems or concerns involved in specifying instructional activities and resources for a lesson.

OBJECTIVE: By the conclusion of this assignment, you will be able to plan a lesson and specify instructional activities and resources, using the Instructional Package Worksheet.

EVALUATION: Participant review and discussion of completed Instructional Package Worksheets will serve as the evaluation activity for this assignment.

DIRECTIONS:
1. Complete the exercise described below. Use the Task Detailing Sheets and Lesson Planning Forms from Unit Six, Lesson Four. This task should take approximately 45 minutes.

2. Discuss completed Instructional Package Worksheet with fellow participants. This task should take approximately 15 minutes.

ASSIGNMENT 7.2

EXERCISE DESCRIPTION

You have already completed initial plans for teaching a lesson on a suspended solids step. You are now ready to develop the lesson activities. Using the Instructional Package Worksheet which is included here, you will write a justification statement, specify instructional resources, and specify the Instructional Approach for a 60-minute lesson on the step you have chosen. The Instructional Approach should contain detailed instructions on kinds of instructional and learning activities. Your Instructional Package Worksheet should be complete enough that any other instructor with experience and responsibilities similar to yours will be able to teach the lesson using the Instructional Package Worksheet. You should also indicate specific kinds of resources that should be used in the conduct of the lesson, such as figures, handouts, content outlines, and the like. Be prepared to explain and justify your decisions during the discussion which completes the assignment.

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering competencies

Objective

Behavior

Conditions

Acceptable Performance

Justification

Evaluation Activities

Resources

Instructional Approach

BASIC INSTRUCTIONAL TECHNOLOGY
PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT EIGHT
DEVELOPING ORAL COMMUNICATION SKILLS

Estimated time for unit - Two hours

The CONTENT of this unit:

This unit identifies the characteristics of effective oral presentations and provides practice in public speaking. Using the Presentation Check List, participants assess each others' presentations.

The OBJECTIVES of this unit:

In this unit, you will learn to:

-list characteristics of an effective oral presentation
-apply principles of effective speaking in a brief oral presentation
-evaluate the public speaking ability of fellow participants

The PURPOSE of this unit:

An instructor is a public speaker, whether the speech is a lecture given to fifty people in a lecture hall or a few sentences of direction or encouragement given to one trainee during a problem-solving session. Since so much of what people learn is communicated orally, an instructor must be conscious of the way in which s/he delivers oral communications.

The RESOURCES for this unit:

1. Content Summary for Presentations
   - I. The Lecture
   - II. The Demonstration
   - III. Guided Discussion
   - IV. Adaptive Instruction
2. Presentation Rating Scale

UNIT EIGHT: DEVELOPING ORAL COMMUNICATIONS SKILLS
CONTENT SUMMARY

Oral presentations must be spoken, not read.

1. Maintain eye contact with audience.
2. Use humor to establish and maintain rapport with audience.
3. Use a variety of voice tones and volumes.
4. Create an atmosphere of informality by appearing relaxed.
5. Use language that is appropriate for the audience.
6. Check frequently to determine degree of audience interest and understanding.
7. Allow space for occasional questions and comments from audience.
8. Show enthusiasm for the topic.

The speaker's body must not distract attention from the content of the presentation.

1. Be poised; do not pace around, shuffle feet or papers, or wave hands.
2. Have all equipment and materials ready and organized before beginning.
3. Always face your audience, even when using media.
4. Keep your hands still when not demonstrating a procedure or pointing to an item in the media.

The presentation must be organized and logical.

1. Orient the audience to provide motivation for listening.
2. Inform the audience of the structure of the presentation.
3. Emphasize major points - with media as appropriate.
4. Summarize major points at the end.

I. The Lecture (Method #1)

A. Definition - uninterrupted speech by which one presents information to others

B. Characteristics of a Good Lecture

1. The lecturer has good public speaking skills

2. The presentation is

a. brief - usually no more than 15-20 minutes of uninterrupted speech; a lecture should not strain normal attention span

b. organized

i) the introduction
(a) establishes rapport between lecturer and learners
(b) defines the purpose of the lecture, gains learners' attention, and motivates them to remain attentive
(c) outlines the major points of the lecture
(d) defines the objectives of the lecture

ii) the body
(a) uses a simple-to-complex structure for presenting the content
(b) aims toward specific objectives
(c) provides opportunities for questioning
(d) allows for practice of knowledge

iii) the conclusion
(a) reviews and summarizes main points
(b) opens opportunity for student responses
(c) provides directions to the next activity

c. accompanied by media (when appropriate)

i) highlighting - visual accompaniments such as outlines, graphics, pictures - reinforce content during the lecture

ii) student handouts - "take-homes" such as outlines, procedural guidelines, etc. - serve as a personal employee manual for on-the-job use

C. Advantages

1. Presents large amounts of information from many or from hard-to-get sources in short amount of time

2. Gives instructor control over the kind of information and organization presented

3. Provides the most efficient way to introduce and to summarize a learning experience

D. Disadvantages

1. Over-stresses acquisition of facts

2. Can make learners into passive, dependent receivers of information

3. Is instructor-paced

4. Is often too long

5. Is often over-used or misused

6. Is not for teaching "how to" (procedures)

7. Depends for success on instructor's public-speaking ability

II. Demonstration (Method #2)

A. Definition - showing, as opposed to telling, how to do something by manipulating appropriate materials and equipment

B. Characteristics of a Good Demonstration

1. The instructor prepares site and materials

a. on-location or simulated site is chosen and prepared for maximum effectiveness and visibility to all learners

b. materials and equipment obtained and tested by working through demonstration

c. setup allows everyone to see demonstration

d. media/handouts prepared to complement demonstration - i.e., steps outlined, decision points and criteria defined, "success" described in terms of predefined criteria

2. The instructor prepares for the students

a. necessary orientation information developed

b. mini-lectures for introducing and summarizing the procedure prepared

c. frequent opportunities provided to ask questions

d. frequent checks to ensure student understanding

e. opportunities to practice the procedure

C. Advantages

1. Gives on-the-job experience

2. Allows learners to develop and practice skills under supervision

D. Disadvantages

1. Not useful alone; must be prepared for and summarized through lecture or reading

2. Large groups of learners require much time for practice in order to be effective

3. Useful only for fixed-step procedures, not for creative problem solving

4. Requires equipment, materials, often site visits

III. Guided Discussion (Method #3)

A. Definition - a sharing of ideas and opinions in order to arrive at a mutually acceptable decision or solution to a problem

B. Characteristics of a Good Discussion

1. Not a bull session - topics and objectives must be carefully prepared and purpose explicitly defined so that group will know when discussion should end

2. Groups should be small enough to allow everyone to participate and large enough to avoid polarization or domination by a few

3. Discussion leader

a. initiates discussion by stating topics, objectives, guidelines (rules for participating, parameters of discussion)

b. coordinates discussion by summarizing ideas and establishing relationships among ideas

c. orients discussion by pulling discussion back to topic; avoids playing expert and giving lectures

d. encourages participation by warmth, non-critical analysis of contributions, questioning silent members in non-threatening way

e. harmonizes the group by dealing with personal confrontations and disagreements and arbitrating as necessary

f. gate-keeps by preventing anyone from dominating the group

4. Participants

a. participate - purpose is to share ideas in order to develop solution to problem

b. remain non-critical and objective - avoid personal attacks and emotional analyses like "that's stupid"

c. stick to the topic

d. avoid private discussions and share ideas with whole group

e. direct comments and questions to group rather than to leader

f. accept leader as arbitrator of group

5. Physical environment is arranged to facilitate discussion by ensuring eye contact among all participants

C. Advantages

1. Allows all members of group opportunity to share ideas

2. Provides for mutual solving of a problem and practice in ways of solving problems

D. Disadvantages

1. Can be dominated by an individual or faction

2. Can degenerate into an exchange of abuse

3. Can bog down in extended, uncomfortable silence or irrelevancies

4. Can be a front for leader-provided lectures

5. Can be misused (not suitable for communicating factual information or teaching procedures)

IV. Adaptive Instruction (Method #4)

A. Definition - to adapt instruction to individual needs, goals, learning materials and/or instructional methods and techniques are especially chosen to suit a particular student or group of students

Types of Adaptive Instruction - individualized learning packages, assignments, tutorials

B. Characteristics of Good Adaptive Instruction

1. Characteristics of effective individualized learning packages

a. provides all the information and materials learner needs to know on his/her own

b. provides for practice and feedback

c. is structured properly (orienting overview, body with logical learning steps, summarizing review)

d. meets individual needs of learners

2. Characteristics of effective assignments

a. application oriented - allows students to apply knowledge and skills in new or unfamiliar contexts

b. allows for choice - provides options so that the students can choose among alternative assignments, contexts, or subjects

c. builds skills in specific steps from simplest to most complex

d. provides feedback reinforcement

3. Characteristics of effective tutorials

a. is a one-to-one session between tutor and learner (tutor need not be the instructor)

b. has problem-solving orientation using stages of diagnosis and remedy

c. builds skills in specific steps

d. tutor guides learner to discover answers - does not lecture at learner

e. session is problem-specific and ends when solution is discovered

C. Advantages

1. Responsive to individual needs

2. Allows for learner pacing and repetition as desired

3. Individualized learning packages can be given out when it is difficult to organize a class or too few students or no instructor available

4. Tutorials can be used to help several learners with difficult problems in a short space of time

D. Disadvantages

1. Instructor-made individualized learning packages are expensive to prepare

2. Not suitable for complex or complicated subject matter

3. Not useful for teaching procedures that require equipment or complicated materials

4. Does not allow for exchange of ideas and opinions - basically a lonely method of learning

Presentation Rating Scale

Name of Presenter_____Topic_____

Directions: The following are some important characteristics of good instructional presentations. Check the column on the right that best represents your impression of this presenter's performance on each characteristic. Do not complete the form until the presentation is over. It should only take a few minutes to complete this form. Remember that the purpose of this rating scale is to provide corrective feedback to the presenter.

	Excellent	Very Good	Adequate	Poor	Does not Apply
A. Delivery Techniques					
1. Obtained the attention of the audience at the start	___	___	___	___	___
2. Attempted to match the presentation to the audience's background and preparation	___	___	___	___	___
3. Projected warmth, friendliness, confidence, and interest in the subject	___	___	___	___	___
4. Talked with sufficient volume to reach all listeners.	___	___	___	___	___
5. Varied stress, intonation and pacing as appropriate	___	___	___	___	___
6. Used humor when appropriate	___	___	___	___	___
B. Composure					
7. Maintained relaxed posture during the presentation	___	___	___	___	___
8. Refrained from pacing or shuffling feet	___	___	___	___	___
9. Used no distracting mannerisms	___	___	___	___	___
C. Organization					
10. Began with a clear introduction, including purpose and overview	___	___	___	___	___
11. Provided clear and useful organization for material	___	___	___	___	___
12. Emphasized and/or repeated important points	___	___	___	___	___
13. Incorporated examples and illustrations	___	___	___	___	___
14. Allowed for audience feedback through questions and comments	___	___	___	___	___

Use the back of this form for any additional comments or suggestions you might wish to make.

BASIC INSTRUCTIONAL TECHNOLOGY
PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT NINE
DEVELOPMENT OF FIRST PRESENTATIONS

Estimated time for unit - One and one-half hours

The CONTENT of this unit:

This unit provides practice in making original oral presentations. Given IPWs from Unit Ten, participants will plan and deliver brief oral presentations on topics relating to media and related resources. Feedback will be provided on participants' oral speaking abilities.

The OBJECTIVE of this unit:

In this unit you will learn to:

-design, practice and deliver a five- to ten-minute oral presentation on a topic relating to media.

The PURPOSE of this unit:

One of the workshop's goals is to provide participants with opportunities to practice making instructional presentations. In this unit participants are able to apply some of their new instructional skills by preparing a short presentation on a selected lesson from Unit Ten materials. These presentations will then be used to teach the content of Unit Ten. Participants will also receive corrective feedback on their presentations.

Note: No content summary is provided for this application exercise.

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT TEN
INSTRUCTIONAL MEDIA AND RELATED RESOURCES

Estimated time for unit - Five hours thirty minutes

The CONTENT of this unit:

This unit introduces topics in media selection and utilization and resource centers and systems available to EPA professionals. Through individual presentations, participants will provide instruction in selecting and preparing media, operating equipment and utilizing resources in EPA. This unit provides the content for the oral presentations that are the substance of Unit Nine.

The OBJECTIVES of this unit:

In this unit you will learn to:

-produce simple and effective instructional graphics and overhead transparencies.
-operate overhead projectors, slide projectors, and at least one form of motion picture projector.
-identify and obtain instructional media using IRIS, IRC, and/or local sources.
-plan and evaluate the appropriate use of instructional media by applying principles of media selection.

The PURPOSE of this unit:

Media have become an integral part of modern instruction. Through EPA's Instructional Resources Information System (IRIS) and Instructional Resources Center (IRC) a variety of mediated materials are available relevant to environmental quality control subjects. This unit is designed to provide the basic information and skills needed to select and employ media in support of effective instruction. Among the topics to be covered are the preparation of instructional graphics and overhead transparencies, the operation of simple audio-visual equipment, the location and identification of media resources, and the principles of appropriate media use.

The RESOURCES for this unit:

1. Content Summary
2. Reading: Selecting Media for Instruction
3. IRIS Sample Abstracts

UNIT TEN: INSTRUCTIONAL MEDIA AND RELATED RESOURCES
CONTENT SUMMARY

Purposes of Unit

1) Using media to complement verbal instruction
2) Practice in public speaking

Principles of Instructional Graphics

1) Visual tools of graphics
   - -line
   - -shape
   - -space
   - -texture
   - -color
2) Principles of design
   - -simplicity
   - -unity
   - -emphasis
   - -balance
   - -appeal
   - -functionalism

Equipment Operation

1) Overhead projectors
2) Slide projectors
3) Motion picture projectors

Instructional Uses of Media - guidelines, advantages and disadvantages

1) Overhead transparencies
2) Slides and filmstrips
3) Audiotapes
4) Motion pictures
5) Instructional television

Media Selection

1) Criteria for selecting media
   - -cost
   - -ease of use
   - -flexibility
   - -durability
2) Criteria applied to types of media
3) Selecting an instructional medium

Resource Dissemination Systems

1) IRIS
2) IRC
3) Community resources

UNIT TEN: INSTRUCTIONAL MEDIA AND RELATED RESOURCES
LESSON 12 of 15: MEDIA SELECTION

Reading

SELECTING MEDIA FOR INSTRUCTION

The goal of teaching is to increase the abilities of students. The selection of media for this purpose should be based on the efficiency, effectiveness, and economy of the medium in accomplishing the desired objective. These three terms: efficiency, effectiveness, and economy refer to the ability of the medium to accomplish the desired task in the least amount of time, with the maximum level of competency and at the lowest cost. To be able to make the best decision as to which medium may be most appropriate, it is necessary to know something about the characteristics of the various media, their advantages and limitations and their relative cost to prepare.

Selection often times ends up being based on the materials presently available to the teacher or on the basis of the medium we are most comfortable with. The information in this reading will consider the characteristics of the various media and the factors which should be considered in selection. It is hoped that this information will provide you with a basis for selecting the medium which has the greatest potential for assisting your students in achieving desired objectives.

Before considering various media individually, it should be pointed out that no single medium will likely be suitable for accomplishing your objectives. A combination of media or multi-media approach recognizes that different media serve best various instructional purposes and also that students vary in the type of learning activity which is most appropriate for them tc learn most efficiently and effectively. A multi-media approach to instruction provides alternative resources and alternative ways of learning.

Photographic Print Series

A photographic print series consists of sequences of pictures of drawings and/or photographs of various items, processes, situations, etc. These photographs may be made in black and white or in color. Color prints are considerably more expensive than black and white prints. Photographic prints series are usually accompanied by explanatory captions, printed text, or audio-tape material to provide for direction in using and interpreting the visual ideas presented. This type of material lends itself to individual use as part of a programmed learning activity.

Slide Series

Photographic slides are perhaps the most common locally produced projected material used in instruction. These slides are ready for use after they are returned from a film processing laboratory. Satisfactory slides can be produced with inexpensive "instamatic" type cameras. However, for copy work requiring extreme close-ups and for photographing materials under extreme light conditions, an adjustable 35mm camera is desirable. A 35mm camera with close-up adapter and a copy stand can be purchased for approximately $300 to $400.

Many 35mm cameras have built-in exposure meters making them relatively easy to operate whether used for copying or photographing live subjects.

Slides are small and can be easily stored. The sequences of slides can be easily changed and new slides added, providing flexibility in changing and up-dating of slide series. Unless slides are stored in trays or magazines, they can become out of sequence or be placed in the projector backwards or upside down.

Projection equipment for 35mm slides allows the instructor maximum flexibility in using this medium. Using the remote control features, the instructor can change the slides while making his presentation and even turn the projector on and off by remote control. Tape recordings can be made on either reel-to-reel or cassette tape to accompany a slide series. Synchronization equipment is available which will permit semi-remote control projectors to be automatically advanced by an inaudible signal placed on the tape.

This medium can be used with either large or small groups. Small, compact rear-screen viewing equipment now available makes this medium ideal for small group or individual use with or without a taped narration.

Film Strips

Thirty-five millimeter filmstrips are similar to slides but, as the name indicates, are on a strip of film as opposed to individually mounted slides. The primary advantage of filmstrips is their compactness and ease of handling. Since the pictures are always in order, there is no possibility of wrong positioning. However, because of the fixed sequence filmstrips do not have the flexibility of slides in terms of rearrangement and replacement. Damage to filmstrips resulting from improper handling is difficult to repair.

Local production of filmstrips is difficult for the beginner. Commercially produced filmstrips are usually prepared from enlarged photographs, drawings, and titles, which are photographed with a 35mm single frame camera. Commercial film laboratories will convert your 35mm slides to a filmstrip. There are some precautions which need to be taken in doing this, as part of the slide area will be lost due to differences in the ratio between a filmstrip frame and the picture area of a slide. Use of filmstrips is desirable when a fixed order of pictures needs to be maintained. The reproduction costs of a filmstrip are significantly less than for slides.

Filmstrips are generally accompanied by a narration in the form of captions on individual frames or an audio narration on a disk or tape recording. Most filmstrips produced today have an audio narration with inaudible signal provided on the tape or disk to automatically advance the filmstrip from frame to frame when used on automatic advance equipment. In addition to use with regular filmstrip projectors, filmstrips can also be used with compact filmstrip viewers, some of which also utilize cassette tapes, making them very useful for independent study.

Tape Recording

The development of the compact cassette recorder has made the use of tape recordings a popular instructional activity because of the ease and convenience of using this type material. Although audio materials can be prepared for group listening, they are commonly now used for individual listening. When recorded materials are used by themselves, they are often combined with printed or projected material for self instruction. Using the tape recording as a means of instruction is most advantageous when the material is designed for individual listening. The convenience to the student and the ability to move through the material at a pace which is most suitable for him makes this a valuable instructional media.

Local production and duplication of tape recordings is relatively easy. High speed cassette copiers can be purchased for less than $1000. When making recordings for instructional use, there are several things which should be kept in mind. It is desirable to write out what you are going to say (to prepare a script) so that the material is well organized and has a high degree of continuity. Materials which are recorded extemporaneously usually have large numbers of pauses which are typical of "live" lectures. In order to keep the listener actively involved during the listening activity, it is desirable to have a study guide which requires the listener to record answers to questions or note important points made in the recording. The study guide may also include visual materials which will assist the listener in interpreting the oral presentation. Whenever possible, it is desirable to keep listening activities to under 30 minutes.

Overhead transparencies

One of the most popular media used in instruction is the transparency for use on the overhead projector. Simple processes for making transparencies, the dramatic effect of the medium (using techniques such as progressive disclosure and the use of overlays) and light-weight portable projectors have made this probably the most widely used of all projected media.

The overhead projector is used in the front of the room, allowing the instructor to face students. Because the projector can be used in room light at a moderate level, other activities requiring demonstrations, use of models, objects, specimens, and photographs can be carried out at the same time as the transparency is being used. The transparency allows the instructor to be an active participant in the presentation. The instructor can point to the features on the transparency, write on it, or use the spread techniques of overlays and progressive disclosure to add impact and clarity to the presentation.

There is a wide range of techniques for making transparencies. Some require little skill or training while others require special equipment and expertise in photography and graphics. In addition to locally produced transparencies there are many commercially prepared transparencies available, particularly in the area of science.

Motion Pictures

Where motion is essential to the concept being taught, the motion picture should be considered. The motion picture also can have a dramatic impact through the use of documentary film or through film portrayals by actors and actresses. Through the use of various filming techniques such as time-lapse photography, slow motion, close-ups, photomicrography and animation, it is possible to bring to an instructional situation very meaningful learning experiences.

Although there are literally thousands of films available on a wide variety of topics, you may not find one which will meet your specific needs. Production of 16mm films generally requires costly equipment, and skilled personnel and much money for material and services. Super 8mm camera equipment available today makes it possible for a person with little knowledge of cameras to make good quality 8mm films. Simple 8mm projectors are available, many using film cartridges, making this a valuable type of material for individual or small group use. Some 8mm cameras available today will allow you to add sound to your films while they are being made. Alternately, the sound may be added later.

Television

Television programs are often made up of a combination of media. Within the same program, there may be slides, film, photographs, charts, graphs, etc. In televison, these media are not ends in themselves, but rather contributors to the design of an effective television presentation.

Television bears some similarity to motion pictures in that both involve motion and sound. Although studio level production is complex and costly, with simple television systems utilizing a single camera, it is possible to produce effective instructional materials. With television the sound and picture are recorded simultaneously in synchronizaton which is difficult to do with motion pictures. The ability to view immediately what was recorded is an important advantage of television. If necessary, the program can be erased and re-recorded. Portable cameras and video tape recorders make it possible to produce television programs at almost any location. The cost and size of color television cameras has been reduced significantly making possible a wider range of uses for television. The video cassette has made the operation of video tape recorders as simple as the operation of the audio cassette recorder.

In the past, television has been considered a medium of instruction which was most appropriate for reaching large groups. With the ease of locally producing television programs with simple television systems and the development of the video cassette, greater consideration is being given to individual study carrel facilities.

On the following pages is a table summarizing the characteristics of the various media which have been considered. This table can serve as a reference in considering the advantages and limitations of each medium.

Table No. 1
Summary of Characteristics of Educational Media Materials

MATERIAL	ADVANTAGES	LIMITATIONS
Photographic print series	1. Use is self-paced 2. No equipment is required 3. Sequence and selection are flexible	1. Not adaptable for large groups 2. Require photographic skills, equipment, and darkroom for preparation 3. Easily damaged through excessive or careless handling
Slide series	1. May be adapted for large group or individual use 2. Result in colorful, realistic reproductions of original subjects 3. Easily revised and up-dated 4. Easily handled, stored, and rearranged for various uses 5. Can be combined with taped narration for greater effectiveness 6. Equipment is light-weight and portable	1. Require some skill in photography 2. Require special equipment for close-up photography and copying 3. Can get out of sequence and be projected incorrectly if slides are handled individually
Filmstrips	1. Are useful for groups or individuals 2. Compact, easily handled, and always in proper sequence 3. Can be supplemented with captions or recordings 4. Inexpensive 5. Equipment is light-weight and portable	1. Cannot easily be prepared locally 2. Permanent sequence cannot be rearranged or revised

MATERIAL	ADVANTAGES	LIMITATIONS
Recordings	1. Easy to prepare 2. Can provide applications in most subject areas 3. Equipment is compact, portable, easy to operate 4. Flexible and adaptable as either individual elements of instruction or in correlation with programmed materials 5. Duplication easy and economical	1. Have a tendency for overuse, as lecture or oral textbook reading 2. Fixed rate of information flow 3. Limited attention span of learners requires brief presentations (no more than 30 minutes) 4. Need some printed accompaniment such as users' guide
Overhead transparencies	1. Can present information in systematic, developmental sequences 2. Use simple-to-operate projector with presentation rate controlled by instructor 3. Can be prepared by variety of simple, inexpensive methods 4. Particularly useful with large groups 5. Can be combined with other media in a presentation	1. Require special equipment, facilities, and skills for more advanced preparation methods 2. Difficult to store 3. Easily damaged or destroyed
Motion pictures	1. Particularly useful in describing motion, showing relationships, or providing dramatic impact 2. Are useful with groups of all sizes and with individuals 3. 8mm film reduces cost for materials and services 4. Sound is easily added to magnetic film	1. Fairly expensive to prepare or purchase 2. Production equipment requires special training to use 3. Equipment rapidly becomes obsolete

MATERIAL	ADVANTAGES	LIMITATIONS
Motion pictures (con't)	5. Insure a consistency in presentation of material	
Television	1. Permits use of motion 2. Permits use of many media during program 3. Permits normally unavailable resources to be presented 4. Playback capability of video recording permits analysis of on-the-spot action 5. Adaptable for use with groups or individuals	1. Equipment is expensive and cumbersome 2. Special training needed to operate equipment 3. Production costs are high

UNIT TEN: INSTRUCTIONAL MEDIA AND RELATED RESOURCES
LESSON 13 of 15: INTRODUCTION TO IRIS

IRIS Sample Abstract

Entry in IRIS Only

EW003821

PUBLICATION DATE: [78]

TITLE: WPCF Wastewater Treatment Plant Operator Training Program, Intermediate Course: Student Workbook, Vol. A, Parts 1 and 2.

INSTITUTION NAME: Water Pollution Control Federation

AVAILABLE FROM: Water Pollution Control Federation, 2626 Pennsylvania Ave., Washington, D. C. 20037

DESCRIPTOR: *Activated Sludge; Audiovisual Aids; Certification; *Clarification (Wastewater); Environmental Technicians; *Instructional Materials; Job Skills; *Operations (Wastewater); Pollution; *Post Secondary Education; *Wastewater Collection; *Wastewater Treatment; Water Pollution Control

DESCRIPTIVE NOTE: 244 pages. Course Materials: 35 mm slides (340), 9 tape cassettes, administrator handbook, carrying case, and student workbook (parts 1 and 2) -order no. E0291, $400.00; student workbook only - order no. E0292, $4.50; other volumes: EW003822 and EW003823

This document is one in a series of self-instructional workbooks for training wastewater treatment plant operators in the basic functions of facility operation. The workbook contains a pre- and post-test questionnaire for each unit as well as self-tests as interim guides. The units discussed in the volume are a general introduction, the community wastewater system, pre-treatment, clarification, and activated sludge. (CS)

UNIT TEN: INSTRUCTIONAL MEDIA AND RELATED RESOURCES
LESSON 13 of 15: INTRODUCTION TO IRIS

IRIS Sample Abstract

Entry in IRIS and ERIC

EW003836 ED157796

PUBLICATION DATE: [71]

TITLE: A Guide to the Common Diatoms at Water Pollution Surveillance System Stations.

PERSONAL AUTHOR: Weber, Cornelius I.

INSTITUTION CODE: BBB06755

INSTITUTION NAME: Environmental Protection Agency
Cincinnati, Ohio

AVAILABLE FROM: EDRS Price MF-$0.83 HC-$6.01 PLUS POSTAGE

DESCRIPTOR: Biology; Environment; *Instructional Materials; *Microbiology; *Plant Identification; Post Secondary Education; Science Education; *Taxonomy; *Water Pollution Control; Water Resources; *Diatoms

DESCRIPTIVE NOTE: 107 pages; Graphs may not reproduce well

ISSUE: RIE DEC 78

This guide was developed by the United States Environmental Protection Agency (EPA) as a taxonomic reference for the identification of diatoms. The taxonomic information included consists of a generic key to the common genera of diatoms, a section illustrating 164 diatom species representing 43 common genera found at the Water Pollution Surveillance System (WPSS) stations, and an alphabetical list of the genera included in this publication. Related information includes collection and slide preparation procedures, a description of the structure of the diatom cell wall, and a glossary of terms used in diatom taxonomy. Also included is a map of the WPSS station locations in the United States and charts indicating the four most abundant diatom species at these WPSS stations. No information is given on the ecology of diatoms. (MR)

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT ELEVEN
CLASSROOM MANAGEMENT

Estimated time for unit - One hour

The CONTENT of this unit:

This unit introduces variables in the physical and interpersonal environment that the instructor should consider in planning a class. Techniques for managing the class and maintaining attention are also described.

The OBJECTIVES of this unit:

In this unit you will learn to:

-identify various important variables in the physical and interpersonal environment of the classroom and predict their impact on instructional effectiveness.
-Describe and give examples of basic techniques for classroom management and maintaining attention.

The PURPOSE of this unit:

No matter how well-planned and prepared the instruction is, failure to consider and control certain variables in the classroom environment can severely lessen the effectiveness of that instruction.

The RESOURCES for this unit:

1. Content Summary

UNIT ELEVEN: CLASSROOM MANAGEMENT
CONTENT SUMMARY

There are two major kinds of environmental influences on the effectiveness of instructional communication:

1. physical environment - the setting for the instruction
2. psychological environment - the learner's attitudes and dispositions towards the instruction or the setting

Considerations when planning instruction include:

-selection of methods and media
-rewards
-class schedule
-degree of formality

Techniques for managing class and maintaining attention include:

-beginning with overview
-noting progress
-directing attention
-maintaining participation
-maintaining appropriate pace and variety
-moving around classroom
-counseling problem students
-treating all students equally

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT TWELVE
DEVELOPMENT OF SECOND PRESENTATIONS

Estimated time for unit - Three hours

The CONTENT of this unit:

Unit Twelve gives participants an opportunity to apply many of the skills they have learned throughout the workshop. Each participant defines the objectives, develops evaluation items, and designs the instruction for a fifteen minute lesson. These lessons will be presented and evaluated as part of Unit Thirteen activities.

The OBJECTIVES of this unit:

By the end of the unit you will have used the Instructional Package Worksheet to prepare a presentation on one lesson on a selected area of this workshop. You will work from your own notes and information supplied by the instructor to prepare this lesson. During Unit Thirteen you will be evaluated on your actual instructional presentation.

The PURPOSE of this unit:

Quite simply, this unit is intended to provide you with further practice in applying the various concepts and skills you learned from preceding units.

The RESOURCES for this unit:

1. Blank IPW

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering competencies

Objective

Behavior

Conditions

Acceptable Performance

Justification

Evaluation Activities

Resources

Instructional Approach

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT THIRTEEN
WORKSHOP SUMMARY

Estimated time for unit - Five hours

The CONTENT of this unit:

This unit is intended as a review and summary of the basic instructional technology subjects covered in this workshop. Presentations will be given on the following topics:

The Systematic Approach to Training
Problem Analysis
Task Analysis
Defining Objectives
Evaluation Techniques
Instructional Methods Selection
Rules for Effective Instruction
Media Selection
IRIS
Principles of Public Speaking
Classroom Management

The OBJECTIVE of this unit:

Aside from being a general review, specific objectives for each lesson will be developed by workshop participants.

The PURPOSE of this unit:

It will enable you to reinforce your understanding of instructional technology subjects while providing an opportunity to practice your presentation skills.

BASIC INSTRUCTIONAL TECHNOLOGY

PARTICIPANT REFERENCE MANUAL - UNIT OVERVIEW

UNIT FOURTEEN
EVALUATION AND CONCLUSION

Estimated time for unit - One hour thirty minutes

As the conclusion to the workshop, this unit provides participants with an opportunity to receive feedback on their understanding of the major subject areas. Participants are also asked to provide the instructor with feedback on the strengths and weaknesses of the workshop itself.

PLANNING FORMS AND WORKSHEETS

PROBLEM DEFINITION WORKSHEET

(1) Something has caused you to suspect a personnel performance problem. What is it? Describe the problem briefly in the space below.

(2) Identify the specific employees by job or position title (not name) that are involved in or affected by the problem described above.

(3) What are the characteristics of this problem? Check as many of the following items as seem relevant.

A	B	C
___new people have been hired	___undesirable attitudes toward work are present	___everything takes too long
___experienced people have new tasks or responsibilities	___people do not seem to want to work	___there is not enough time to do the work
___new equipment, facilities or technology is being used	___there are no rewards for doing well	___equipment frequently does not work or breaks down often
___new information exists	___employees provide poor service	___supplies sometimes run out
___output of work is low	___people feel that getting job done is not worth the effort	___new management or management policy exists
___people cannot perform a task effectively	___employees rarely receive feedback on their performance	___employees rarely talk to their superiors
___people do not know how to perform a task	___employees are punished for poor performance	___weak or inefficient management is apparent
		___people frequently seem to have nothing to do

(4) In which of the columns (Step 3) are most of the items you checked located?

____A? ____B? ____C?

If A, you appear to have a problem where employees lack skill or knowledge.

If B, the immediate indications are that there is a motivation or incentive problem.

If C, it is likely that you are faced with an environmental problem. (Something in the work setting is preventing people from performing effectively.)

(5) At this point, it is helpful to summarize the information gained in the previous steps. You should now be able to describe your problem in terms of WHO is affected (Step 2), WHAT is involved (Step 3), and WHY (Step 4). (You may also want to gather some further information about the specific nature of the problem at this point in order to develop more specific answers to the WHO, WHAT, and WHY questions.)

Write a clear summary of the problem in the following format:

WHO

WHAT

WHY

(If a variety of different jobs are affected by or involved in this problem, it may be useful to construct separate problem statements for each.)

(6) Is a training program a relevant solution to the specific problem defined above? Consider the following points as appropriate to the identified cause of the problem (Step 4).

-If you identified your problem as involving an employee lack of skill or knowledge, you may want to consider a training program.

-If you decided that you have a motivation or incentive problem, you may want to discuss the situation with others to insure that this problem lends itself to a training solution. (Many times a change in organizational policy or management procedures is a more effective solution.)

-If the problem seems to involve something in the work environment, it is rather unlikely that a training program is a relevant

solution. (Investigate the situation further and consider direct changes in the work setting.)

Does a training program represent a relevant solution to your problem?

____ Yes ____ No

What other kinds of actions might be taken to address the problem in combination with or instead of a training program?

Additional strategies:

(7) If you are still certain that some form of training program is called for, proceed to analyze the training need for such a program using the Job Task Summary Sheet. Separate Job Task Summary Sheets must be completed for each job to be the subject of training.

JOB TASK SUMMARY SHEET

A. Job Title _____

1. Describe the job in terms of its major duties (2-4).

A) _____

B) _____

C) _____

D) _____

2. Which duties are most relevant to the problem identified in the Problem Definition Worksheet? Circle the relevant items on the list above.

B. For each duty chosen as relevant to the identified problem, prepare a list of the specific tasks which make up the activities of that duty. (Use additional pages if necessary to describe other duties/tasks.)

DUTY _____

TASKS 1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

DUTY _____

TASKS 1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

C. Should all of the tasks under each duty be considered as subjects for training programs? Circle all the tasks which require training attention, given your definition of the problem. (In deciding whether a specific task should be the subject of a training program, consider its relative importance, frequency of performance, and overall difficulty.)

D. Complete a Task Detailing Sheet for each task to be considered as the focus of a training activity.

TASK DETAILING SHEET

A. Write Job Title _____

B. Write Task _____

Complete steps C - F in the space below.

C. List the specific steps required to perform the task.
D. Check each step which needs to be taught.
E. Indicate whether the checked steps primarily involve cognitive, affective, or psychomotor behavior.
F. For a cognitive behavior, indicate the appropriate level of performance:
   Knowledge - ability to recall information or procedures
   Comprehension - ability to explain information or procedures
   Application - ability to use information or procedures to do something
   Problem Solving - ability to develop new information or procedures

C Steps Required to Perform Task	D Needs to be Taught	E Type of Behavior: Cognitive, Affective, Psychomotor	F Level of Cognitive Behavior: Know., Comp., Appl., P. S.
(1)			
(2)			
(3)			
(4)			
(5)			
(6)			
(7)			
(8)			
(9)			
(10)			
(11)			
(12)			

LESSON PLANNING FORM

Job Title_____ Task_____

Step_____

Type and Level of Behavior_____
(as appropriate)

1) Instructional Objective:

Audience _____

Behavior _____

_____

Conditions _____

_____

Acceptable Performance _____

_____

2) Entering Competencies: _____

_____

3) Evaluation Activities: _____

_____

4) Instructional Methods: *Using the Instructional Methods Selection Table for guidance, choose the method or methods most suitable for reaching the objective and describe how it will be used.*

METHOD(s)_____

_____

_____

5) Instructional Media. *Use the Media Selection Table to guide your choice of media for use in instruction. List all that apply.*

Appropriate Category of Media	Specific Medium & Title Available
_____	_____
_____	_____
_____	_____

6) Sequence of Instructional Activities. *Outline the specific activities which comprise the instructional approach.*

1._____

2._____

3._____

INSTRUCTIONAL METHODS SELECTION TABLE

Types of Behavior \ Instructional Method	LECTURE	DEMONSTRATION	GUIDED DISCUSSION	ADAPTIVE INSTRUCTION*
COGNITIVE, Knowledge	Appropriate for teaching facts	Generally not useful	Generally not useful	Useful and appropriate for conveying factual information
COGNITIVE, Comprehension	Appropriate	Useful as a supportive method to reinforce concept-using	Generally not useful	Appropriate
COGNITIVE, Application	Appropriate for initial presentation of rules	Most appropriate method for teaching rule-using	Generally not useful	Appropriate for initial presentation of rules
COGNITIVE, Problem-Solving	Generally not useful	Useful for problem-solving instruction	Useful and appropriate for developing problem-solving skills	Exercises are useful for teaching problem-solving
PSYCHOMOTOR	Useful only in support of a demonstration	Live or simulated demonstrations are the most effective method for teaching motor skills	Generally not useful	Useful only in support of a demonstration
AFFECTIVE	Usually not effective for motivating trainees or changing attitudes about something	Modelling and simulations are useful for forming attitudes	Group activities such as role-playing are often useful for attitude formation	Generally not useful

*Individualized Learning Packages; Assignments; Tutorials

MEDIA SELECTION TABLE

Categories of Media

Types of Behavior	OBJECTS	STILL PICTURES	MOVING PICTURES	AUDIO MEDIA	WRITTEN MATERIALS
COGNITIVE Knowledge Comprehension Application Problem-Solving	Especially useful with demonstrations. Can be used to teach -recognition and discrimination -rules, principles or sequential steps.	Very useful for all levels of cognitive instruction. Can highlight stress concepts by displaying words, lists of steps, pictures and pictorial segments. Can provide visual cues.	Useful for showing content not otherwise easily brought into the training situation. Usually too costly for presenting still visuals and/or narrative audio.	May have their greatest use when in conjunction with printed matter or projected visuals. Useful if sounds of machines, alarms, etc. must be learned. Inexpensive.	Excellent media for all levels of cognitive instruction. Relatively inexpensive, printed materials allow for self-pacing. Can be used effectively with still pictures and audio materials.
PSYCHOMOTOR	Useful for teaching and trainee practice of performance in manipulating tools and equipment. Especially appropriate for on-the-job training. People can be used to demonstrate physical actions.	Little application. Can portray static positions of moving persons or objects.	Very useful. Can be used to: -model skills requiring motion -slow motion for close examination -provide visual feedback of student performance -demonstrate processes which take place over an extended time period.	Recorded audio materials generally useful in training only when demonstrating speech or hearing-related skills.	Limited application. since motion is difficult to represent. One important use is procedure guides or checklists for skills performance.
AFFECTIVE	Limited application. May be useful if the object is the focus of the desired attitude formation.	Limited application. Slides in combination with audio materials may influence attitude formation.	Excellent for influencing attitudes. Special effects and other visual techniques are especially useful for presenting affective material.	Limited application. Possibly useful for establishing moods or attitudes with background music, special sounds, or unique narration. May be used with slides to influence attitude formation.	Very little application for training materials.

INSTRUCTIONAL PACKAGE WORKSHEET

CURRICULUM:

COURSE:

UNIT:

LESSON:

Estimated time:

Entering competencies

Objective

Behavior

Conditions

Acceptable Performance

Justification

Evaluation Activities

Resources

Instructional Approach

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GLOSSARY

Adaptive Instruction - to adapt instruction to individual needs, goals, learning materials and/or instructional methods and techniques especially chosen to suit a particular student or group of students

Affective Learning - a type of learning which emphasizes development of interests, attitudes, and values

Check List - a list of skills or tasks which the trainee is expected to demonstrate in the satisfactory performance of a job, behavior, etc.

Cognitive Learning - a type of learning which emphasizes intellectual processes. The four levels of cognitive learning are Knowledge, Understanding, Application, and Problem-Solving

Demonstration - showing, as opposed to telling, how to do something by manipulating appropriate materials and equipment

Entering Competencies - skills and knowledge that trainees must possess before they are ready to learn the behavior specified in the objective

Evaluation - the systematic process of collecting, analyzing, and preparing information for the purposes of decision-making. The functions of evaluation in training programs are to determine existing capabilities of employees, to provide feedback to trainees during instructional activities, to provide opportunities for trainees to practice using a new skill and to determine (or certify) the preparation of a trainee to do a particular job

Guided Discussion - a sharing of ideas and opinions in order to arrive at a mutually acceptable decision or solution to a problem

Instructional Approach - the sequence of activities which an instructor uses to teach a lesson

Instructional Design - the systematic process of specifying the goals and means of instruction. Included are the stages of objectives specification, evaluation design, method selection, and lesson planning

Instructional Method - how content is taught

Instructional Objective - a statement that describes an intended outcome of instruction. It describes a proposed change in a learner and gives a description of a specific behavior or performance

IPW (Instructional Package Worksheet) - describes in detail and in order what must be done in order to teach a single objective

IRIS (Instructional Resources Information System) - is an automated information system managed by EPA Information Dissemination Project which acquires, reviews, indexes and announces both print and non-print instructional materials

Job - the occupational title or position held by an employee

Job Description - a statement(s) outlining areas of responsibility (duties) of a given position

Lecture - uninterrupted speech by which one presents information to others

Lesson - instruction which (usually) encompasses a single instructional objective. A set of lessons on related objectives comprise a unit

Lesson Planning Form - a standardized format on which a lesson is planned

Media - means or methods of presenting information aurally and/or visually

Problem - a discrepancy or deficiency between the way things are and the way things ought to be

Psychomotor Learning - a type of learning which emphasizes physical movements requiring agility, speed, precision, or co-ordination

Rating Scale - a list of skills or tasks, but with each so carefully defined as to permit the evaluator to judge the relative quality of the performance

Resources - anything an instructor or trainee uses during instruction as a resource

Tasks - is one of the skills or operations which belong to a specific area of responsibility. Each task usually consists of specific and distinct steps for its completion

Task Analysis - the act of dividing a duty into all of its components. It results in a list of everything an employee must do to advance the work to completion

Unit - instruction on a set of related objectives, each of which is taught in a single lesson